

**USER'S GUIDE**  
**ORMA 80kN/m<sup>2</sup>**

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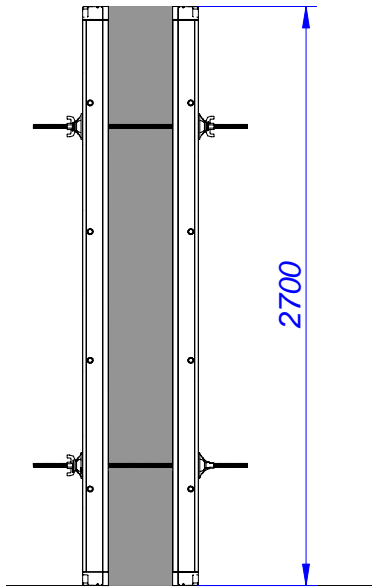


## 1. INTRODUCTION

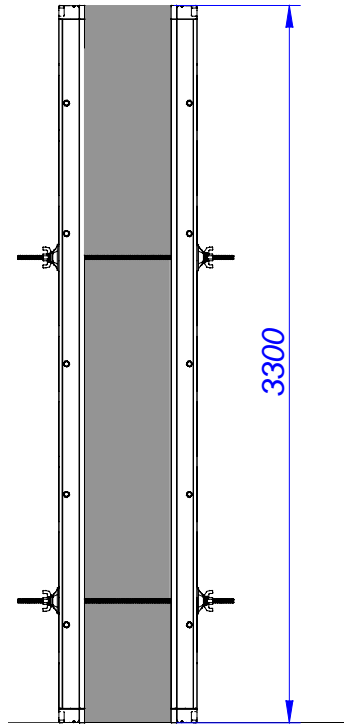
The *ORMA80kN/m<sup>2</sup>* product has been created as a vertical formwork system for wall formworks, focused mainly on the residential building.

Basic properties:

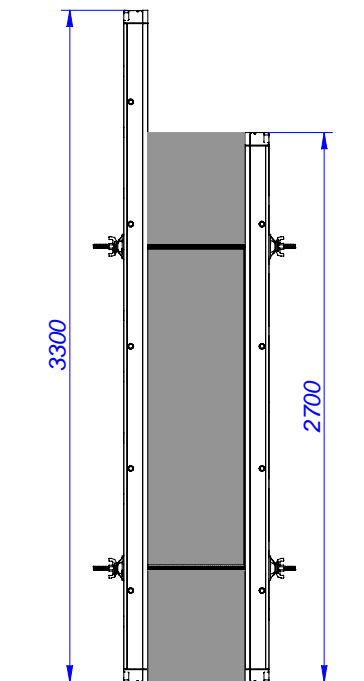
- GSV certification
  - Maximum allowable concrete pressure: 80 kN/m<sup>2</sup>.
  - Maximum deflection: 60 kN/m<sup>2</sup> (line 7)  
80 kN/m<sup>2</sup> (line 6)
- Three height ranges: panels of h=3.3m, h=2.7m and h=1.2m, completely compatible.
- All the panels have lateral metal bushings for solutions like bulkheads, 90° corners and pilasters using the Universal panel
- Panels of the range 3.3m and 2.7m can be assembled face to face
- Big Panel 3.3x2.4 (7.92m<sup>2</sup>) with 3 tying points in height.
  - $h_{\text{pouring concrete}} \leq 3.3\text{m}$ , just 2 tying points in height needed.
  - $h_{\text{pouring concrete}} > 3.3\text{m}$ , 3 tying points in height needed.
- Panel 2.7x2.4 (6.48 m<sup>2</sup>) with just 2 ties in height.
- Width of panels every 15cm.
- Panel joint with Clamp.
- Broad range of panels for columns, (maximun column 120cm x 120cm)
- Robust system. A frame formed by closed steel profile reinforced with rectangular tubes also which protects the phenolic edge of the plywood.
- The form face phenolic plywood is fixed with rivets to the steel frame.
- Safe assembly process.



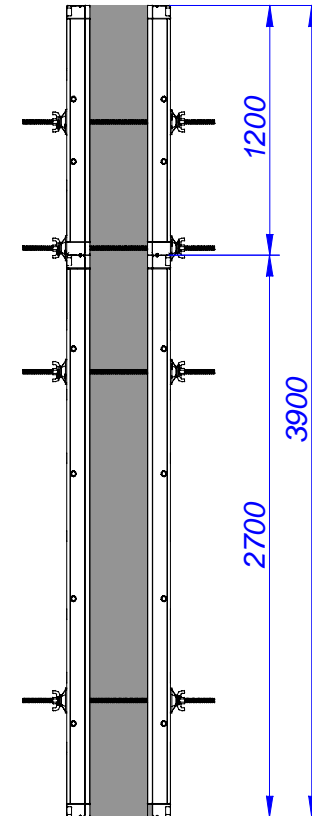
Panel 2.7x2.4 → 2 tying points in height



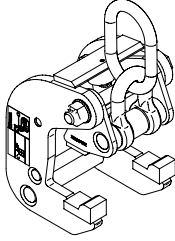
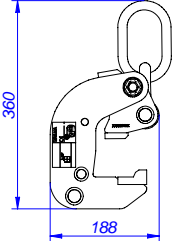
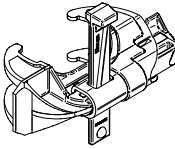
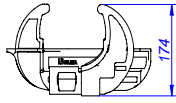
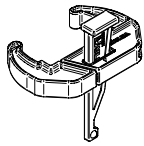
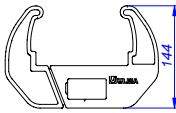
Panel 3.3x2.4 → 2 tying points in height  $h \leq 3.3\text{m}$

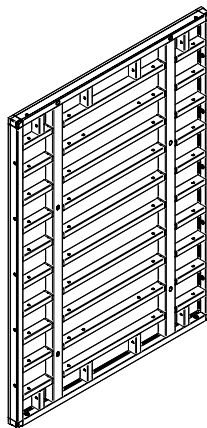
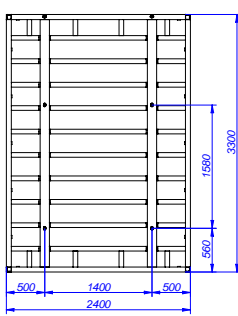
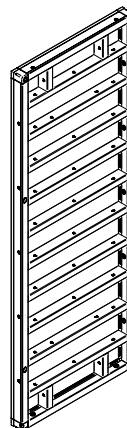
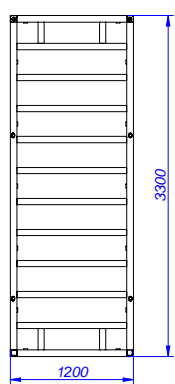
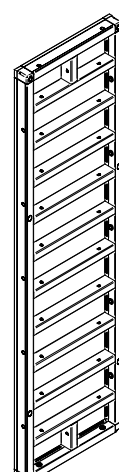
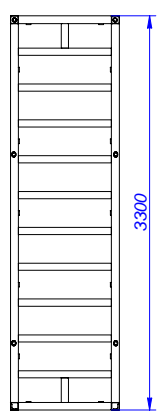


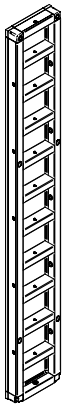
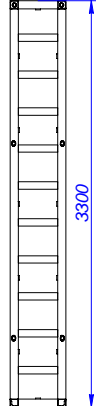
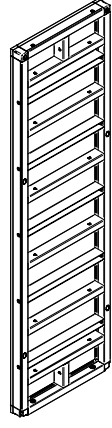
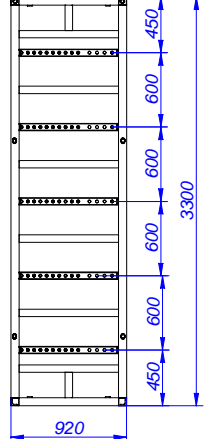
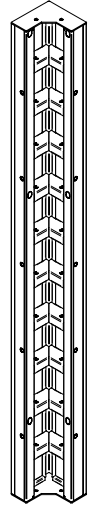
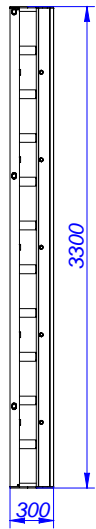
Panel 3.3x2.4 and Panel 2.7x2.4 face to face

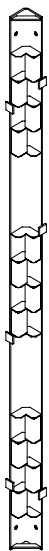
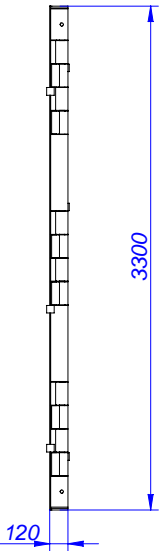
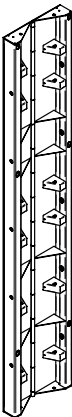
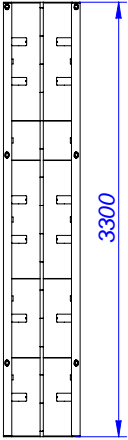

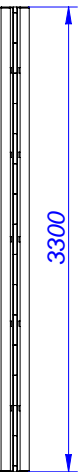


## **2. SYSTEM COMPONENTS**

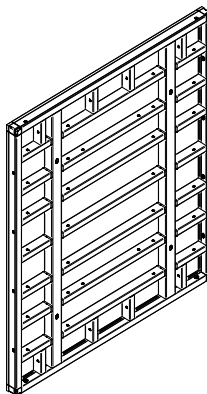
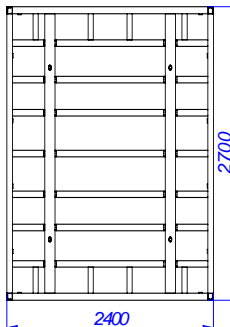
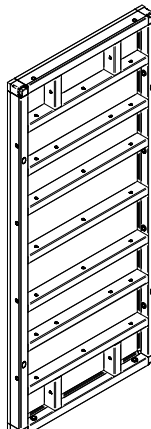
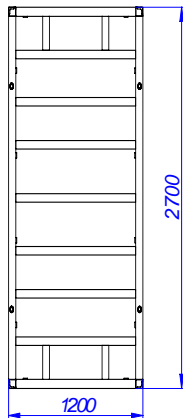
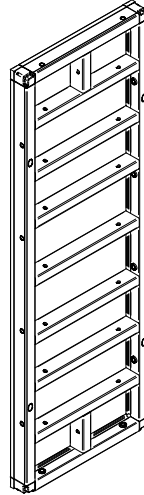
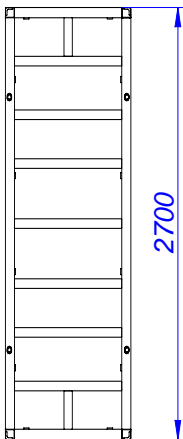
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900179	ORMA LIFTING HOOK	10.6	 <p>ZINC COATED</p>	
1900170	ORMA CLAMP	5.5	 <p>ZINC COATED</p>	
1900894	ORMA FIXED CLAMP	2.9	 <p>ZINC COATED</p>	

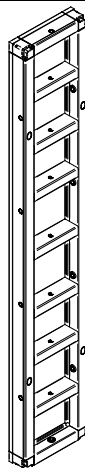
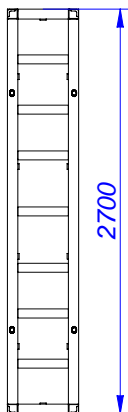
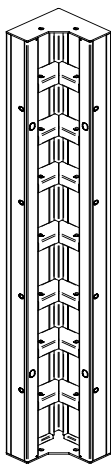
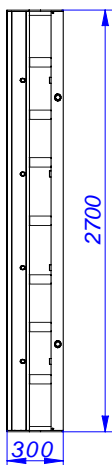

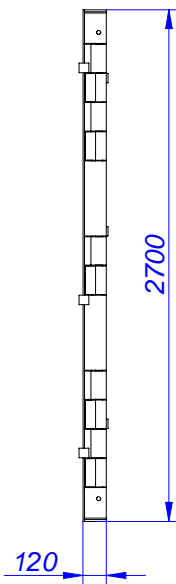
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
RANGE 3.3m				
1908247	PANEL 3.3X2.4	450		
1908250	PANEL 3.3X1.2	208		
1908253	PANEL 3.3X0.9	167		
1908256	PANEL 3.3X0.75	148		
1908259	PANEL 3.3X0.6	130		

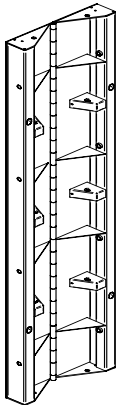
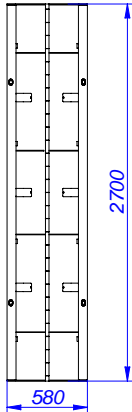
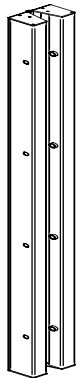
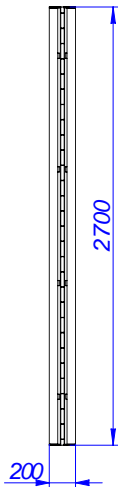
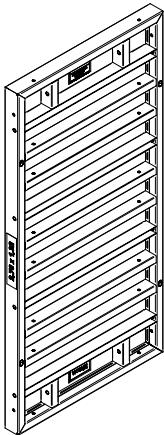
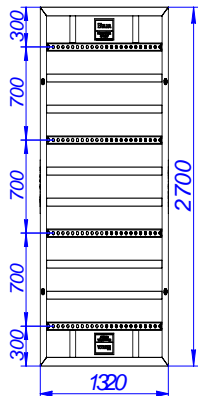
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
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1908265	PANEL 3.3X0.3	88		
1908268	UNIVERSAL PANEL 3.3X0.92	185		
1908271	ORMA INSIDE CORNER 3.3	124		

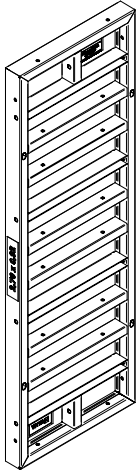
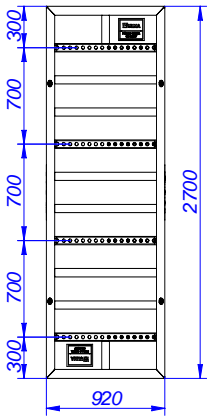
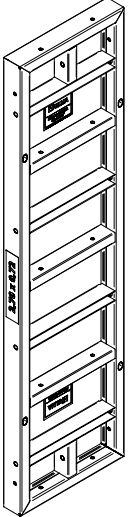
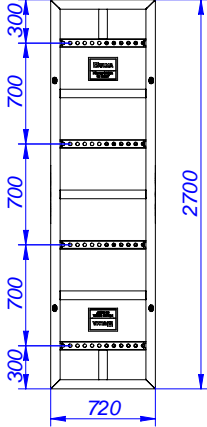
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1908273	ORMA OUTSIDE CORNER 3.3	61	 PAINTED YELLOW	
1908346	ORMA HINGED INSIDE CORNER 3.3	145	 PAINTED YELLOW	
1908357	ORMA HINGED OUTSIDE CORNER 3.3	93	 PAINTED YELLOW	

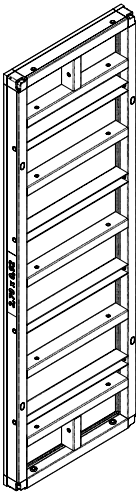
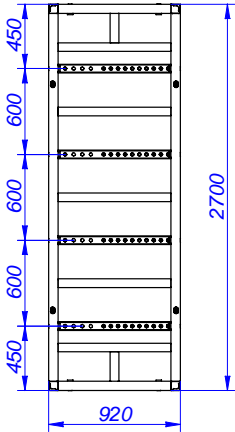
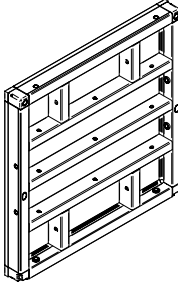
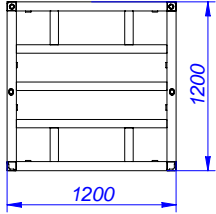
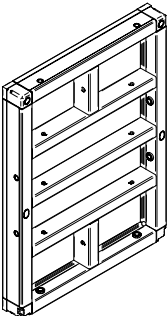
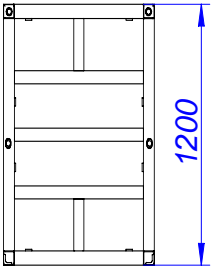


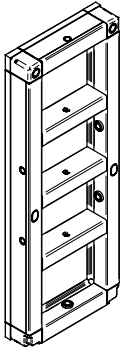
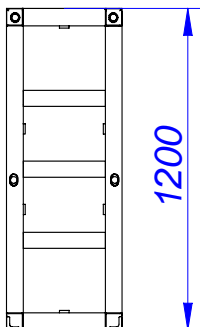
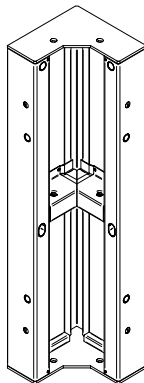
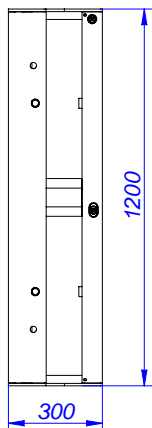
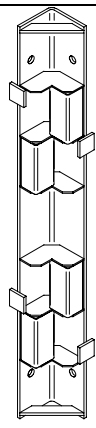
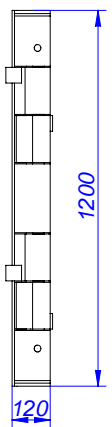
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
RANGE 2.7m				
1900002	PANEL 2.7X2.4	363		
1900005	PANEL 2.7X1.2	167		
1900008	PANEL 2.7X0.9	134		
1900487	PANEL 2.7X0.75	120		
1900011	PANEL 2.7X0.6	105		

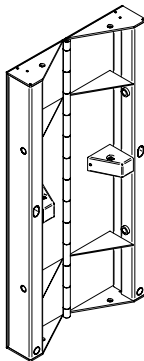
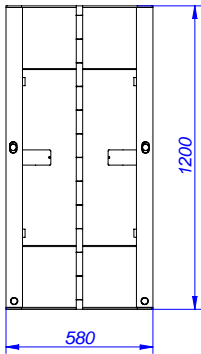
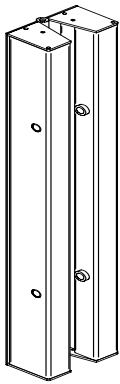
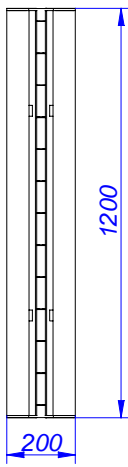
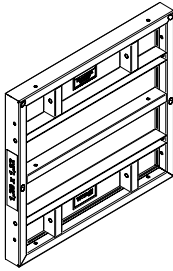
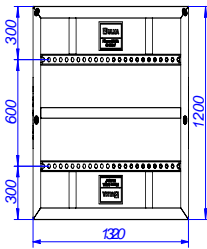
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900020	PANEL 2.7X0.45	86		
1900029	PANEL 2.7X0.3	69		
19000089	ORMA INSIDE CORNER 2.7	100		
1900932	ORMA OUTSIDE CORNER 2.7	51	 PAINTED YELLOW	

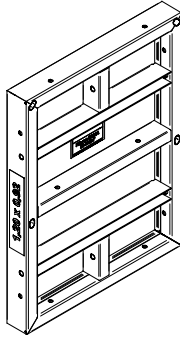
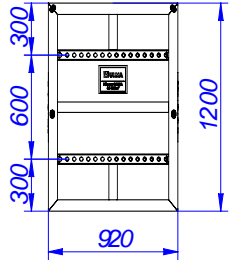
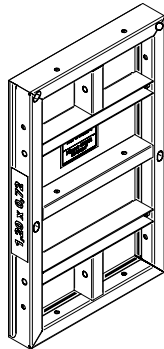
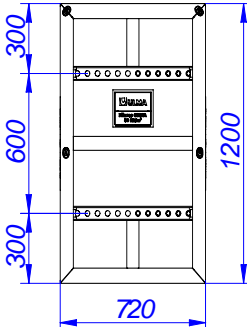
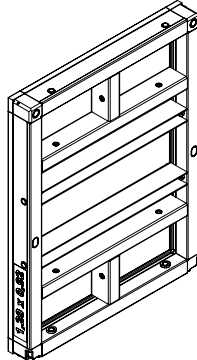
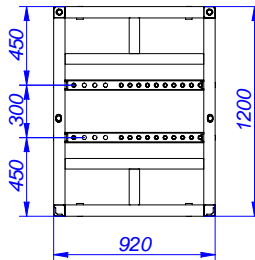
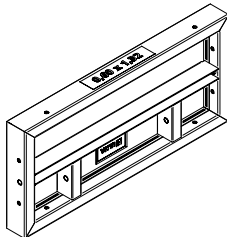
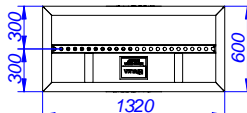
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900096	ORMA HINGED INSIDE CORNER 2.7	118	 PAINTED YELLOW	
1900110	ORMA HINGED OUTSIDE CORNER 2.7	77	 PAINTED YELLOW	
1900341	PANEL COLUMN 2.7X1.32	213		

CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900509	PANEL COLUMN 2.7X0.92	159		
1900354	PANEL COLUMN 2.7X0.72	134		

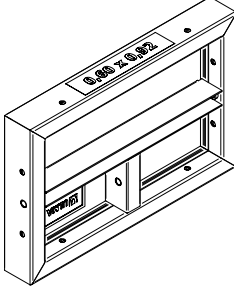
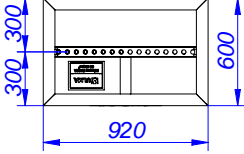
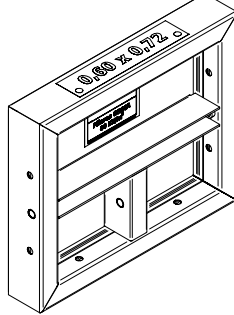
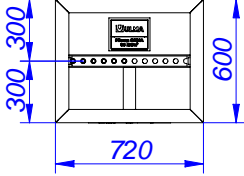
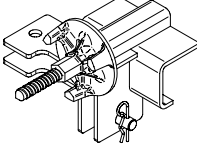
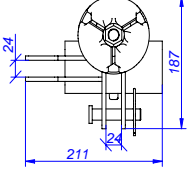
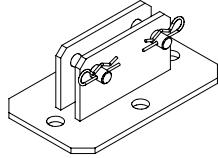
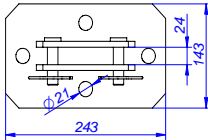
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1908372	UNIVERSAL PANEL 2.7X0.92	159	 PAINTED GREY	
RANGE 1.2m				
1900032	PANEL 1.2X1.2	89		
1900035	PANEL 1.2X0.9	70		
1900490	PANEL 1.2X0.75	62		
1900038	PANEL 1.2X0.6	54		

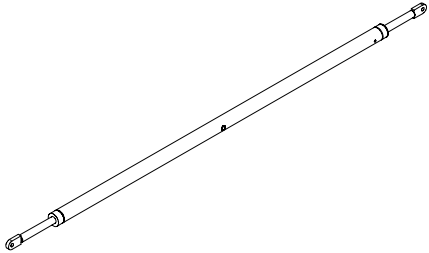
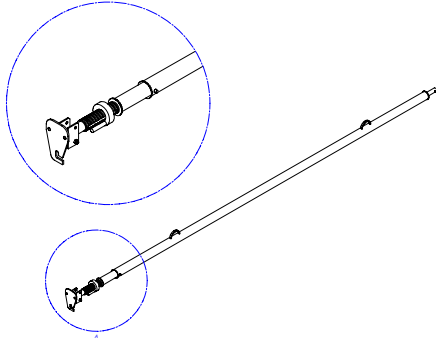
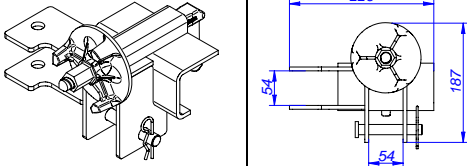
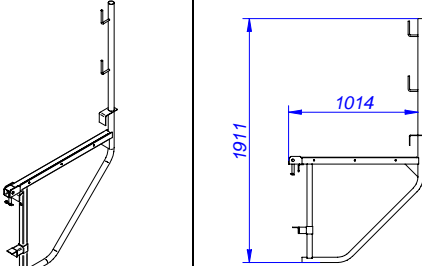
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900047  1900056	PANEL 1.2X0.45  PANEL 1.2X0.3	42.3 34.5		
1900156	ORMA INSIDE CORNER 1.2	48.7		
1900936	ORMA OUTSIDE CORNER 1.2	22.9	 PAINTED YELLOW	

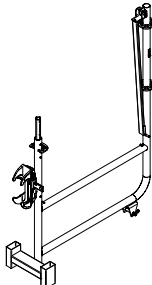
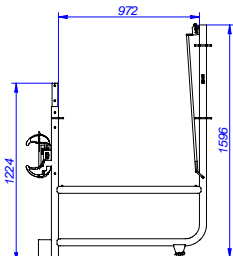
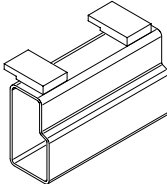
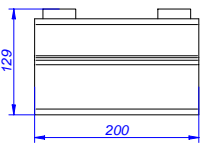
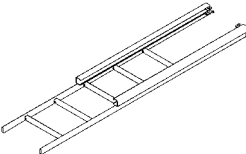
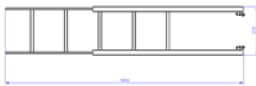
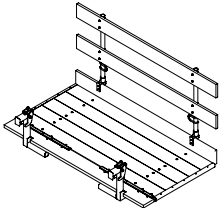
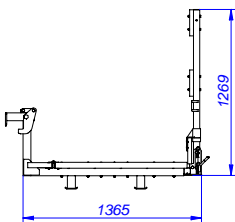
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900164	ORMA HINGED INSIDE CORNER 1.2	55	 <p>PAINTED YELLOW</p>	
1900194	ORMA HINGED OUTSIDE CORNER 1.2	34.8	 <p>PAINTED YELLOW</p>	
1900344	PANEL COLUMN 1.2X1.32	100		

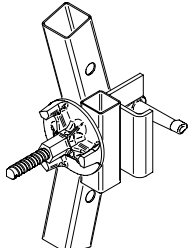
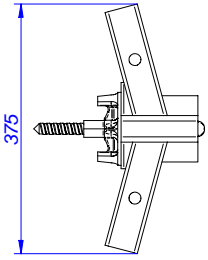
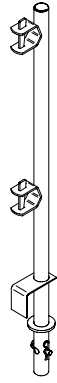
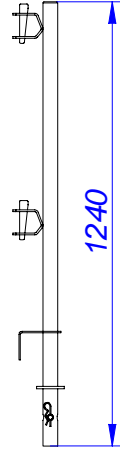
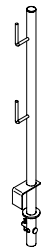
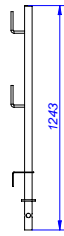
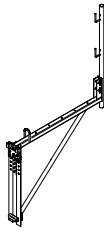
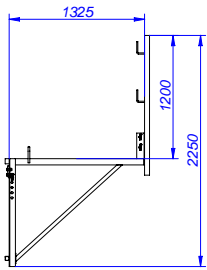
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900515	PANEL COLUMN 1.2X0.92	74		
1900357	PANEL COLUMN 1.2X0.72	62		
1908381	UNIVERSAL PANEL 1.2X0.92	79	 PAINTED GREY	
RANGE 0.6 m				
1900347	PANEL COLUMN 0.6X1.32	58		

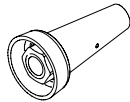
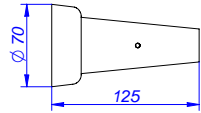
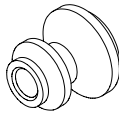
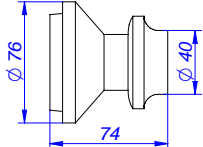
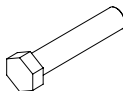
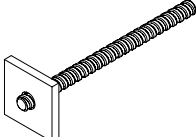

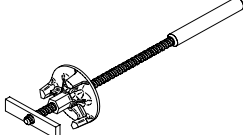
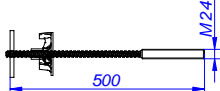
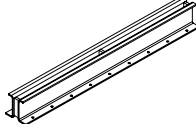
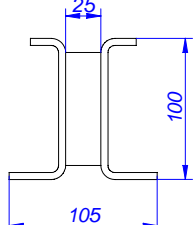
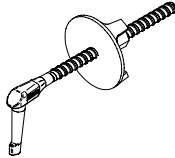
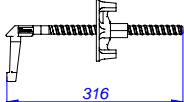


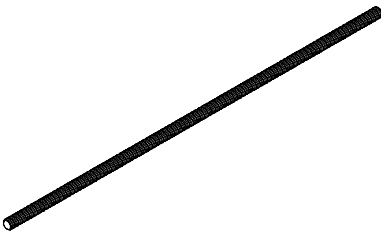
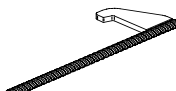
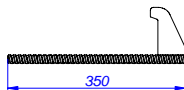

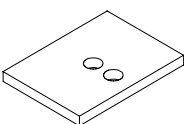
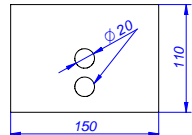
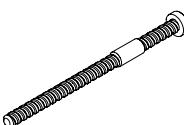
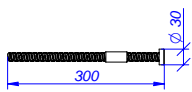
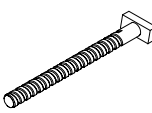
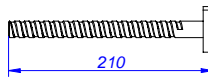
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900518	PANEL COLUMN 0.6X0.92	43.3		
1900360	PANEL COLUMN 0.6X0.72	35		
1900119	HEAD 60	4.5	 PAINTED BLACK	
1900144	PUSH-PULL PROP SHOE	4.3	 PAINTED BLACK	

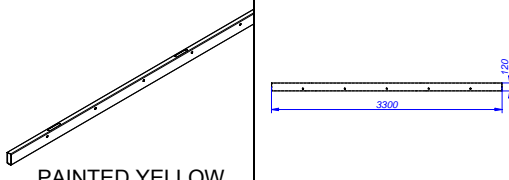
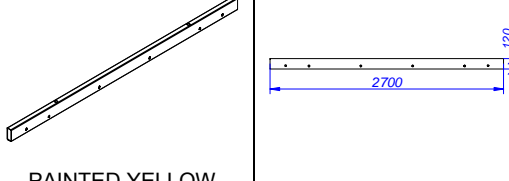
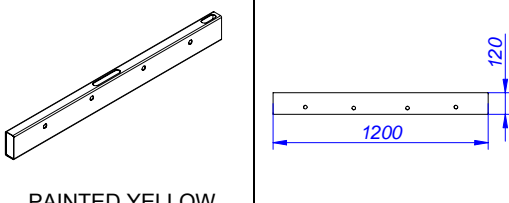
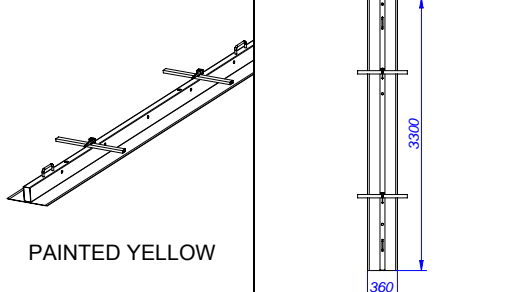
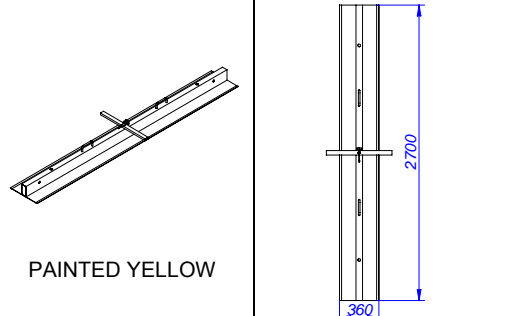
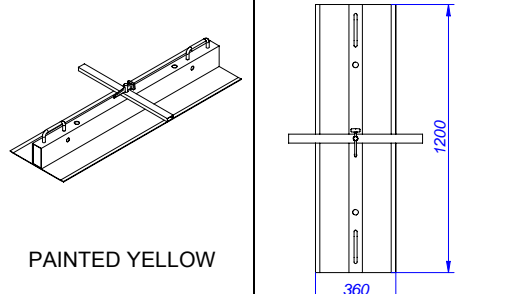
CODE	NAME	WEIGHT (Kg)	DIAGRAM
1900134	PUSH-PULL PROP 1.1-1.7	7.8	 PAINTED YELLOW
1900123	PUSH-PULL PROP 2.4-3.5	24.2	
1908168	PUSH-PULL PROP 3.6-4.8	43.3	
1900147	PUSH-PULL PROP 5-6	51	
1900207	PUSH-PULL PROP 6-10	99	 ZINC COATED
1902219	PROP HEAD	4.6	 PAINTED BLACK
1861094	ORMA WALKWAY BRACKET	14.8	 PAINTED BLACK

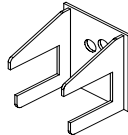
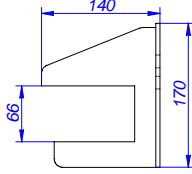
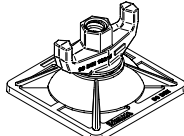
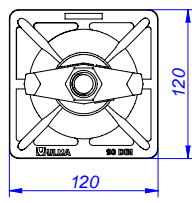
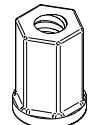
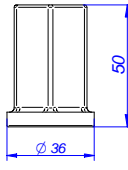
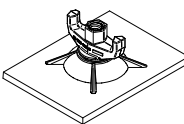
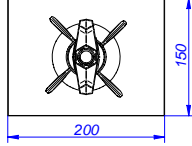
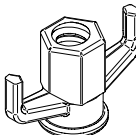
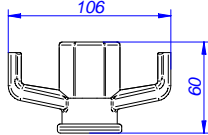
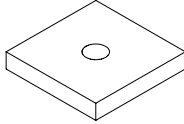
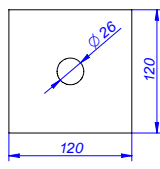
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900908	ORMA-BRIO BRACKET	27.1	 <p>GALVANIZED</p>	
1900890	TYING PROFILE	2.3	 <p>PAINTED YELLOW</p>	
1908363	LADDER SUPPLEMENT	12.2	 <p>GALVANIZED</p>	
1908171	ORMA PLATFORM 2.4x1.2	163		

CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900941	POST BRACKET	3.5	 PAINTED BLACK	
1860516	SAFETY HANDRAIL S-V	3.9	 PAINTED YELLOW	
1902210	SAFETY HANDRAIL POST	3.4	 PAINTED YELLOW	
1900386	ORMA CLIMBING BRACKET	36.5	 PAINTED BLACK	

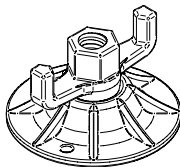
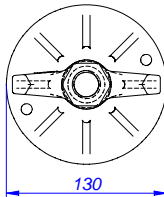
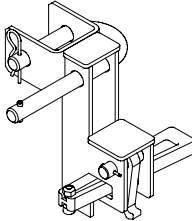
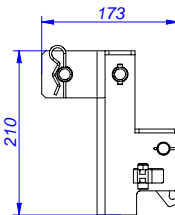
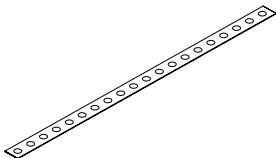
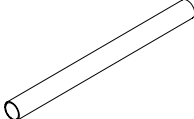

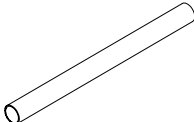
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1901080	CONE DW 15/M24	1	 BICHROMATE TREATED	
1901083	CLIMBING RING 15	0.8	 BICHROMATE TREATED	
9053013	HEXAGONAL SCREW M24x120 DIN931-10.9	0.54	 BLUED	
1900738	LOST TIE ROD 15/0.25	0.7		
1901245	CONE-WALER CONNECTOR	1.9	 ZINC COATED	
1900193	ORMA WALER 0.9	10.9	 PAINTED BLACK	
1900445	ORMA WALER 1.55	18.6		
1900448	WALER HOOK	1.4	 ZINC COATED	

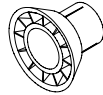
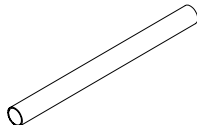
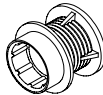
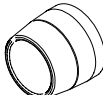
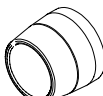
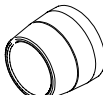
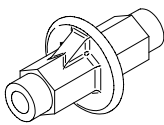
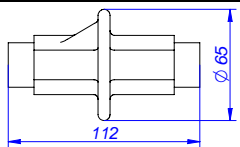
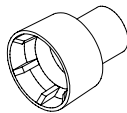
CODE	NAME	WEIGHT (Kg)	DIAGRAM	
0230100	TIE ROD 15/1	1.7		
0230120	TIE ROD 15/1.2	2		
0230150	TIE ROD 15/1.5	2.2		
0230200	TIE ROD 15/2	3.3		
0230600	TIE ROD 15/6	10		
0234100	TIE ROD 20/1	2.9		
0234120	TIE ROD 20/1.2	3.4		
0234150	TIE ROD 20/1.5	4.3		
0234200	TIE ROD 20/2	5.2		
0234600	TIE ROD 20/6	17.2		
1900227	ORMA BULKHEAD HOOK	0.91	 ZINC COATED	
1861033	SHORT PIN 0.35	0.6	 ZINC COATED	
1861034	LONG PIN 0.55	0.8		
1861692	ECCENTRIC WASHER	1.4	 ZINC COATED	
1900265	TIE BOLT	0.6	 ZINC COATED	
1861122	PANEL BOLT	0.3	 ZINC COATED	

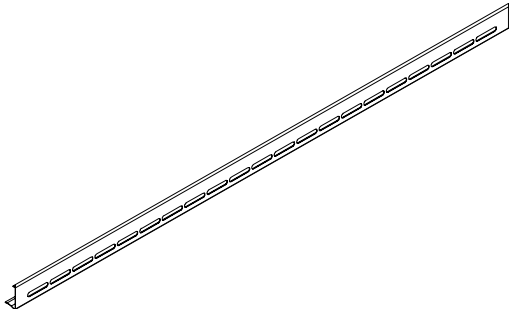
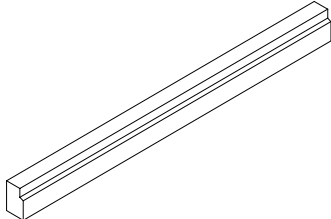
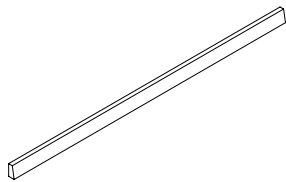
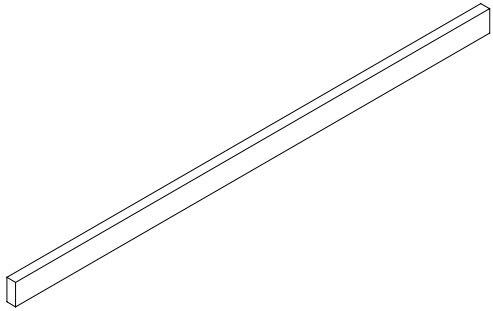
CODE	NAME	WEIGHT (Kg)	DIAGRAM
1908460	COMPENSATION TUBE 3.3	25.3	 <p>PAINTED YELLOW</p>
1900216	COMPENSATION TUBE 2.7	20.2	 <p>PAINTED YELLOW</p>
1900217	COMPENSATION TUBE 1.2	9	 <p>PAINTED YELLOW</p>
1908483	ORMA COMPENSATION PLATE 3.3	49.2	 <p>PAINTED YELLOW</p>
1900423	ORMA COMPENSATION PLATE 2.7	39.8	 <p>PAINTED YELLOW</p>
1900428	ORMA COMPENSATION PLATE 1.2	18.8	 <p>PAINTED YELLOW</p>

CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1900929	TOP TIE BRACKET 65	1.8	 PAINTED BLACK	
1900256	PLATE WASHER NUT 15	1.2	 BICHROMATE TREATED	
7238001	HEXAGONAL NUT 15	0.22	 ZINC COATED	
1908158	PLATE NUT D15 200X150	2.6	 ZINC COATED	
1905046	WING NUT 20	0.37	 BICHROMATE TREATED	
1905047	BASE PLATE D20	2.2	 ZINC COATED	



CODE	NAME	WEIGHT (Kg)	DIAGRAM	
1905160	PLATE WASHER NUT 20	1.2	 BICHROMATE TREATED	 130
1908229	FOUNDATION HEAD	3.4	 ZINC COATED	 210 173
1850453	FOUNDATION PLATE 25	16.6	 ZINC COATED	
7230455	SPACER TUBE 22/25	0.3	 SPARE PART	
7230264	CONE 22	0.006	 SPARE PART	
9371968	SPACER TUBE 32/36	0.4	 SPARE PART	

CODE	NAME	WEIGHT (Kg)	DIAGRAM
9371967	CONE 32	0.03	 SPARE PART
7238047	SPACER TUBE 22/26	0.4	 SPARE PART
7238049	WATER STOP CAP 26	0.009	 SPARE PART
1861799	PLUG 20	0.003	 SPARE PART
1900159	PLUG 22	0.003	 SPARE PART
7238050	PLUG 26	0.004	 SPARE PART
0230004	WATER STOP DW15	0.61	 
9371966	WATER STOP ADAPTER DW15	0.1	 SPARE PART

CODE	NAME	WEIGHT (Kg)	DIAGRAM
1908535	ORMA CHAMFER 3.3M	2.1	
1908505	WOODEN PROFILE 3.3	11.4	
1900439	WOODEN PROFILE 2.7	9.2	
1900440	WOODEN PROFILE 1.2	4.2	
1900494	WOODEN BEVELED EDGE	9.1	
1908506	WOODEN COMP.3.3X0.02	4.4	
1908507	WOODEN COMP.3.3X0.03	6.6	
1908508	WOODEN COMP.3.3X0.05	11	
1900441	WOODEN COMP.2.7X0.02	4	
1900442	WOODEN COMP.2.7X0.03	6.2	
1908443	WOODEN COMP.2.7X0.05	8.3	

## 2.1. PANEL 3.3X2.4

The PANEL 3.3X2.4 is the base element of the ORMA 80kN/m<sup>2</sup> system, since it covers the largest surfaces (7.92m<sup>2</sup>).

These panels have a frame formed by steel perimeter profiles and different rectangular tubes that are welded together. The panel face is phenolic plywood riveted to the frame.

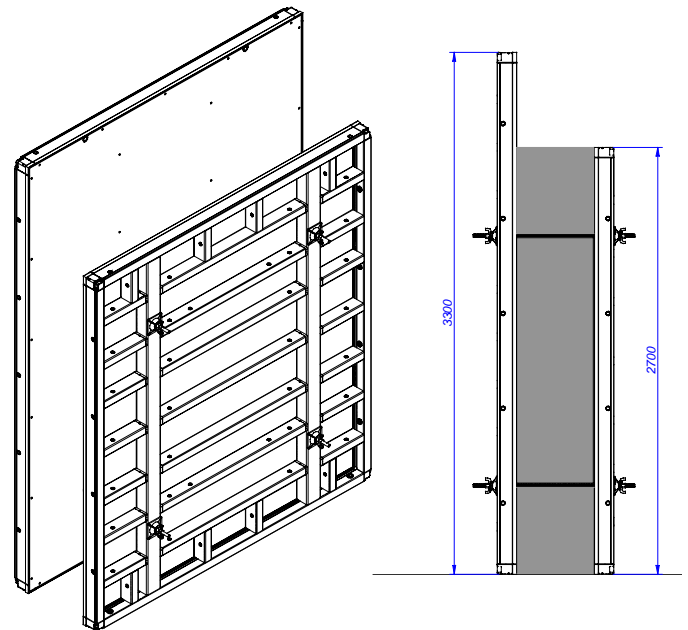
The frame's four corners are stiffened by a especial casting elements (welded to the external profiles). This casting element has a special shape that significantly eases any fine adjustment needed (with a crowbar), after the panels have been deposited by crane.



The frame has two main vertical tubes, which have 4 of the 6 holes for inserting tie rods to support the pressure. The rest 2 holes are on the superior horizontal profile.

These holes, reinforced with metal bushings, allow passing 15mm and 20mm diameter TIE RODS through them.

Panels of the range 3.3m and 2.7m can be brought face to face, because the holes for inserting tie rods are on the same level.

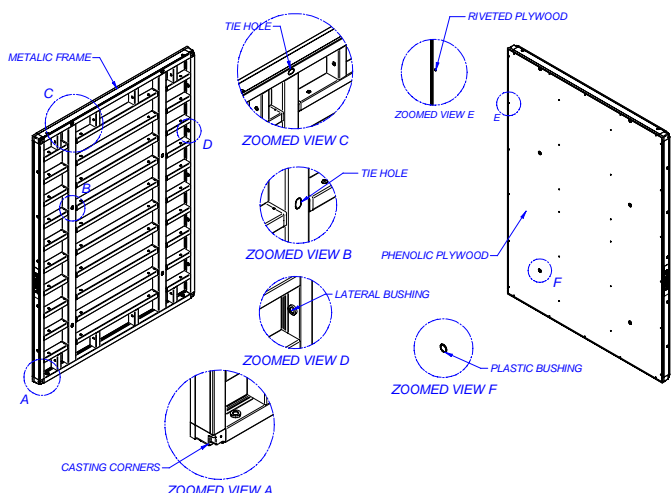


The rectangular tubes provide a rigid structure for the frame, and they incorporate pre-drilled holes that are reinforced with bushings to facilitate assembling the different system accessories.

The vertical 3.3m profiles of the frame have 5 lateral metal bushings for solutions like bulkheads, 90° corners and pilasters.

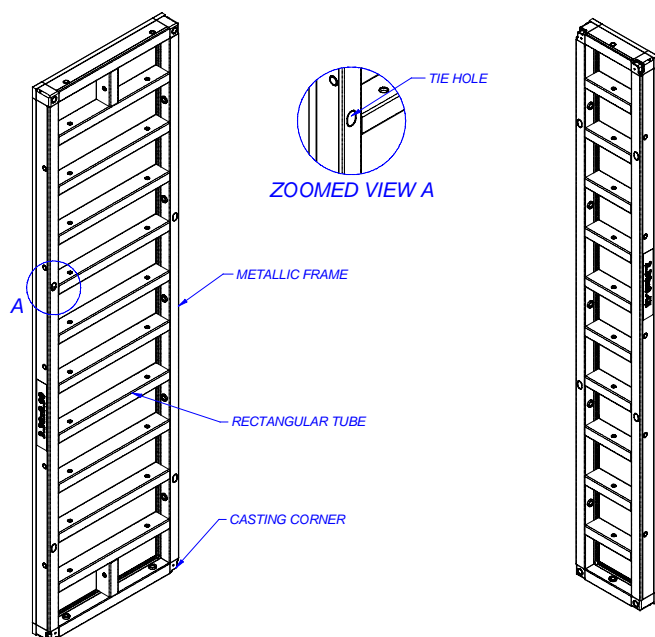
The board in contact with the concrete is 18mm thick phenolic plywood, which is riveted to the steel frame. The plywood edge is protected by the perimeter profile, and the hollow between them is filled with silicone.

The tie holes in the plywood are also protected with plastic bushings to prevent the plywood from being damaged with use.



## 2.2. PANELS 3.3x1.2– 3.3X0.9 – 3.3X0.75 – 3.3X0.6 –3.3X0.45 – 3.3X0.3

The frame of the panels are similar to the PANEL 3.3X2.4. Vertical 3.3m profiles with 5 lateral metal bushings, corners reinforced with special casting elements and rectangular tubes which incorporate pre-drilled holes.

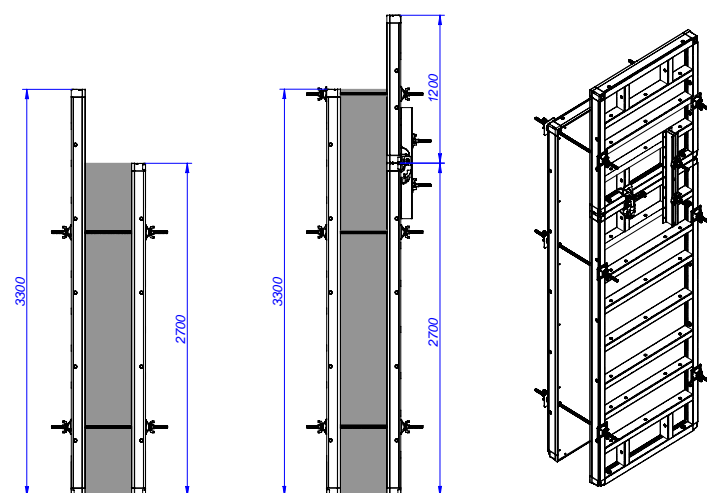


PANELS 1.2 – 0.90 – 0.75 – 0.60

PANELS 0.45 – 0.30

The holes for inserting tie rods to support the pressure are situated on the outside profile. These holes, reinforced with metal bushings, allow passing 15mm and 20mm diameter TIE RODS through them and panels of the same width can be brought face to face with the panels of the range 2.7 and 1.2.

The board in contact with the concrete is 18mm thick phenolic plywood, which is riveted to the steel frame.

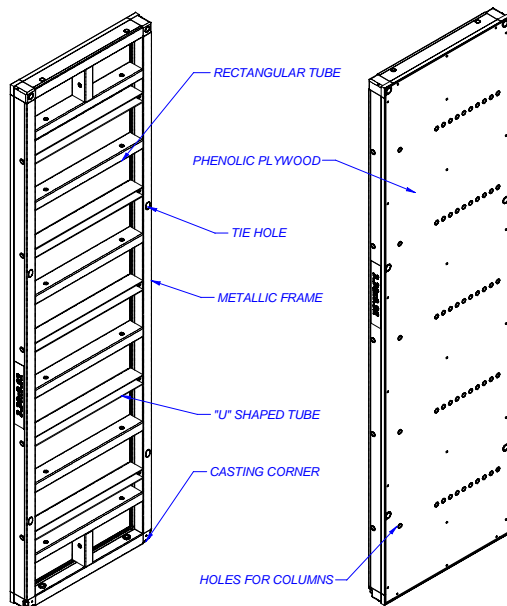


## 2.3. UNIVERSAL PANEL 3.3x0.92

It has a steel frame formed by perimeter profile and ribs, rectangular tubes, but it also has 5 “U” shaped multipunched ribs with holes situated such that the different column dimensions can be achieved using a combination of these holes.

Combining this Universal panel with the other panels of the range 3.3, solutions like bulkheads, pilasters and 90° corners can be done.

They can also be used as wall panels, and they have holes in the perimeter profile where the TIE RODS can be inserted.



## 2.4. PANEL 2.7x2.4

The PANEL 2.7X2.4 has a frame formed by steel perimeter profiles and different rectangular tubes that are welded together. The panel face is phenolic plywood riveted to the frame.

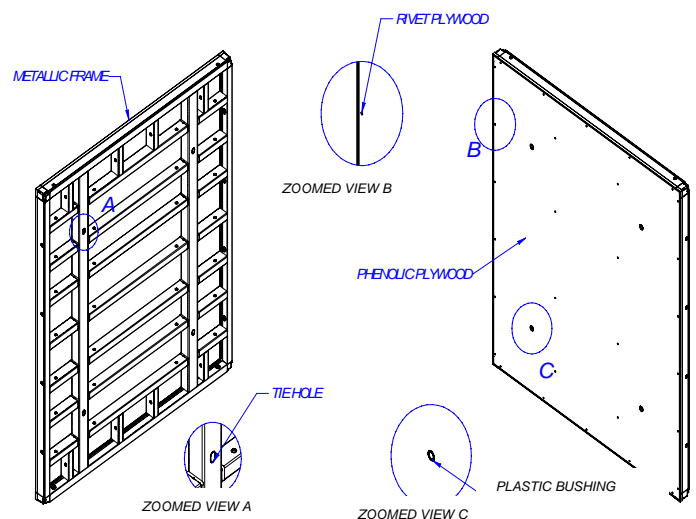
The frame has two main vertical tubes, which have 4 holes for inserting tie rods to support the pressure. These holes, reinforced with metal bushings, allow passing 15mm and 20mm diameter TIE RODS through them.

The rectangular tubes provide a rigid structure for the frame, and they incorporate pre-drilled holes that are reinforced with bushings to facilitate assembling the different system accessories.

Vertical 2.7m profiles with 4 lateral metal bushings and corners reinforced with special casting elements.

The board in contact with the concrete is 18mm thick phenolic plywood, which is riveted to the steel frame. The plywood edge is protected by the perimeter profile, and the hollow between them is filled with silicone.

The tie holes in the plywood are also protected with plastic bushings to prevent the plywood from being damaged with use.

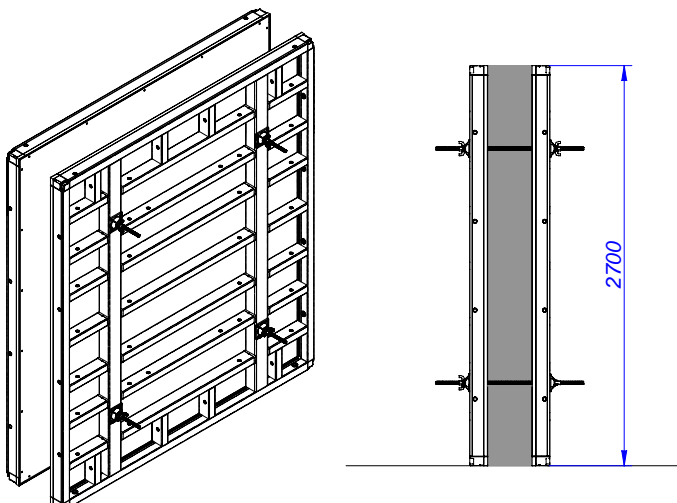


## 2.5. PANELS 2.7x1.2 – 2.7X0.9 – 2.7X0.75 – 2.7x0.6 – 2.7X0.45 – 2.7X0.3

The widths corresponding to the rest of the range of panels are: 1.2, 0.90, 0.75, 0.60, 0.45 and 0.30.

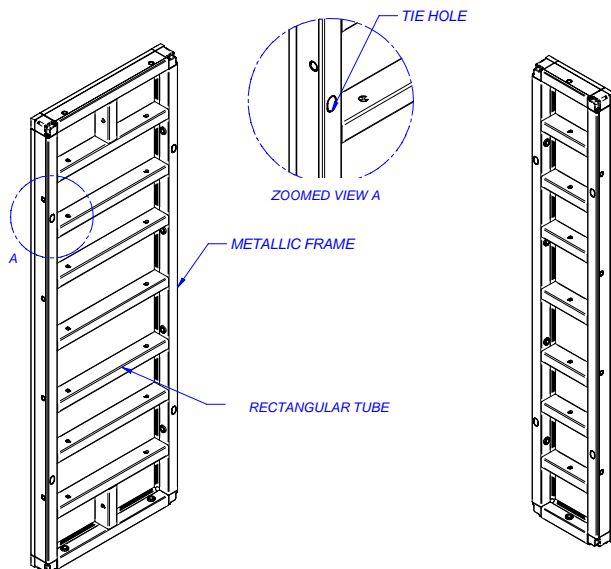
The structure of all the panels is the same as that for PANEL 2.7X2.4 a perimeter profile frame and rectangular tubes welded together.

Vertical 2.7m profiles with 4 lateral metal bushings and corners reinforced with special casting elements.



In these panels' widths, the TIE ROD holes are placed on the perimeter profiles, and they also allow passing 15mm and 20mm diameter TIE RODS.

The board in contact with the concrete is 18mm thick phenolic plywood, and it is riveted to the steel frame.



PANELS 1.2 – 0.90 – 0.75 – 0.60

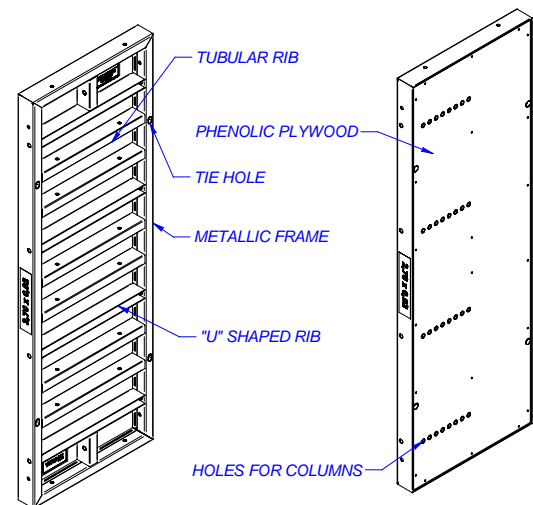
PANELS 0.45 – 0.30

## 2.6. PANEL COLUMN 2.7X1.32, 2.7X0.92 and 2.7X0.72

The panel column comes in three different widths, 0.72, 0.92 and 1.32; which can be combined to achieve a broad range of column dimensions.

As with all panels, it has a steel frame formed by perimeter profile and ribs, rectangular tubes, but it also has 4 “U” shaped multipunched ribs with holes situated such that the different column dimensions can be achieved using a combination of these holes.

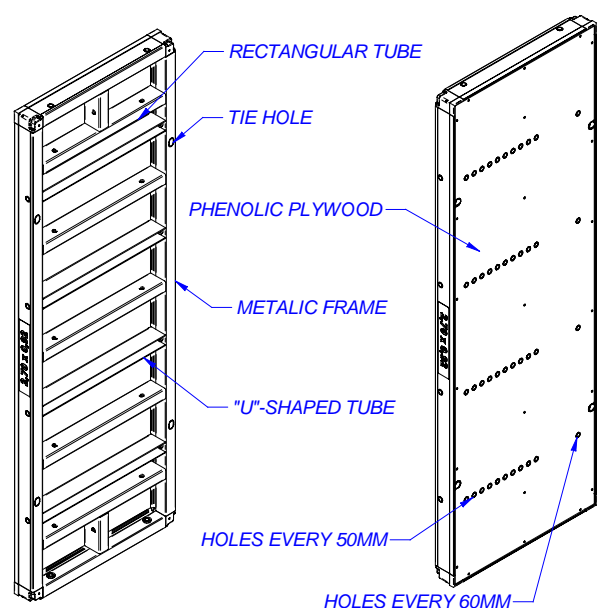
They can also be used as wall panels, and they have holes in the perimeter profile where the TIE RODS can be inserted.



## 2.7. PANEL UNIVERSAL 2.7X0.92

It has a steel frame formed by perimeter profile and ribs, rectangular tubes, but it also has 4 “U” shaped multipunched ribs with holes situated such that the different column dimensions can be achieved using a combination of these holes.

Combining this Universal panel with the other panels of the range 2.7, solutions like bulkheads, pilasters and 90° corners can be done.





They can also be used as wall panels, and they have holes in the perimeter profile where the TIE RODS can be inserted.

It is grey painted not to mix with the panel column 2.7x0.92

## 2.8. PANELS 1.2X1.2, 1.2X0.9, 1.2X0.75 1.2X0.6, 1.2X0.45 and 1.2X0.3

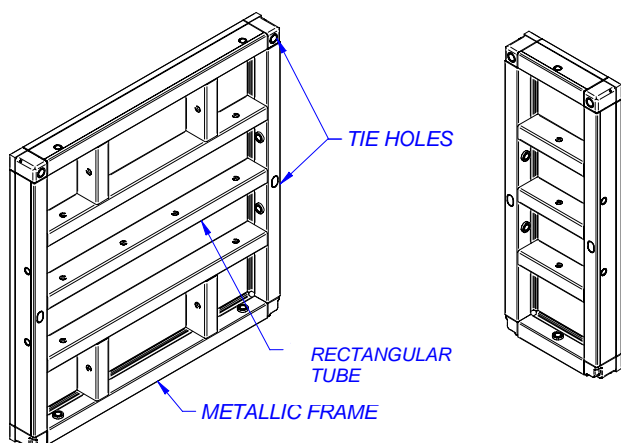
The range of 1.2m high panels is formed by a variety of panel widths including 1.2, 0.9, 0.75, 0.6, 0.45 and 0.3m widths, which are compatible with the 2.7m high panels.

The panel structure is the same as that of the PANEL 2.7X2.4: a metallic perimeter profile frame and rectangular tubes welded together.

In these panels, the TIE ROD holes are placed on the perimeter profiles, and they also accept 15mm and 20mm diameter TIE RODS.

Each panel has two holes in height, one of which is on top of the panel.

The board in contact with the concrete is 18mm thick phenolic plywood, and it is riveted to the steel frame.



PANELS 1.2 – 0.90 – 0.75 – 0.60

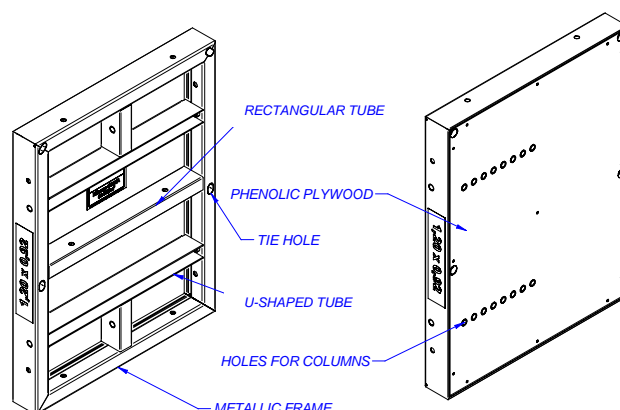
PANELS 0.45 – 0.30

## 2.9. PANEL COLUMN 1.2X1.32 – 1.2X0.92 – 1.2X0.72

In the 1.2m high panel column range, 1.32, 0.92 and 0.72m wide panels are available, and they can be used in combination with all other panel height ranges.

As with all panels, it has a steel frame formed by perimeter profile and ribs, rectangular tubes, but it also has 2 “U” shaped multipunched ribs with holes situated such that the different column dimensions can be achieved using a combination of these holes.

They can also be used as wall panels, and they have holes in the perimeter profile where the TIE RODS can be inserted.

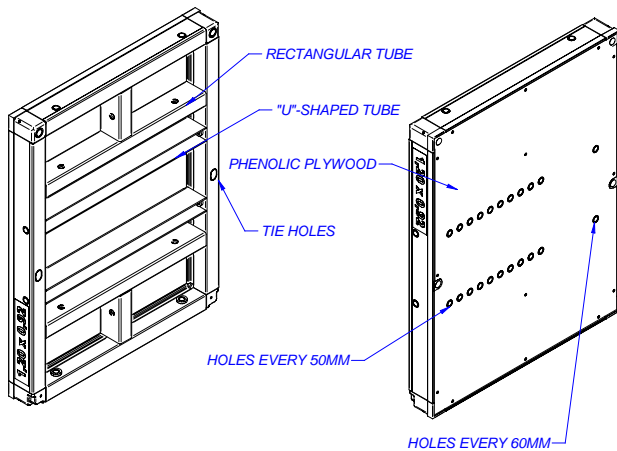


## 2.10. UNIVERSAL PANEL 1.2X0.92

It is used for the same solutions as the 2.7m Universal panel. They have 2 “U” shaped multipunched ribs with holes.

It is grey painted not to mix with the panel column 1.2x0.92



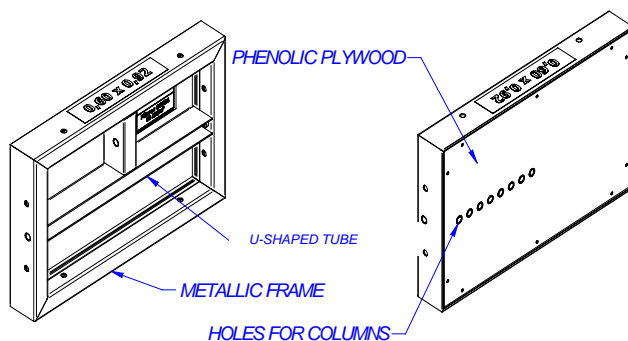


### 2.11. PANEL COLUMN 0.6X1.32– 0.6X0.92 – 0.6X0.72

In the 0.6m high panel column range 1.32, 0.92 and 0.72m wide panels are also available, and it can also be used in combination with all other panel height ranges. It is basically used to complement the other panel heights in order to adjust the column height, and it is used at the top of the formwork.

As with all panels, it has a steel frame formed by perimeter profile and ribs, rectangular tubes, but it also has 1 "U" shaped multipunched ribs with holes situated such that the different column dimensions can be achieved using a combination of these holes.

These panels do not have holes for TIE RODS since they are only used in column construction.

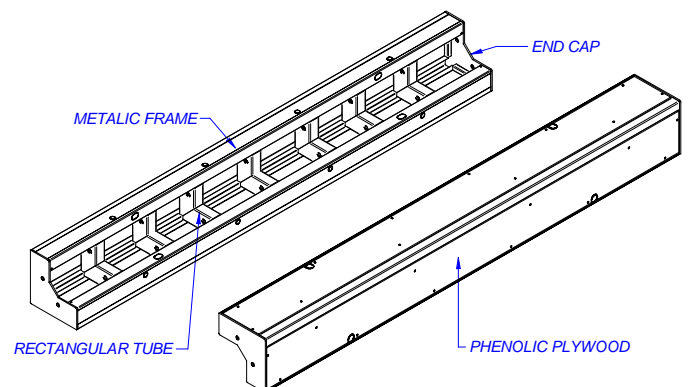


### 2.12. ORMA INSIDE CORNER 3.3– 2.7–1.2

These elements are used on the inside face of 90° wall corners. They are 30cmx30cm side panels formed by a steel frame with phenolic plywood riveted to it.

They have two vertical profiles with holes for TIE RODS. Several rectangular tubes with their reinforced holes are welded one to another along the vertical profile of the frame to enclose the structure, and there are 2 plates welded on the top and the bottom of the frame.

The board in contact with the concrete is 18 mm thick phenolic plywood, and it is riveted to the steel frame.

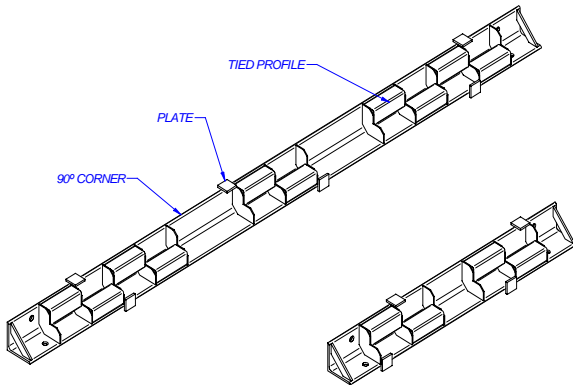


### 2.13. ORMA OUTSIDE CORNER 3.3– 2.7- 1.2

These elements are used on the external face of 90° corners, and they are generally used in combination with the INSIDE CORNERS on the other face.

They are formed by a steel sheet bent at a 90° angle, and they have several welded steel profiles that are used to join the adjacent panels with CLAMPS.

To facilitate assembly, they also have plates that support the corner against the panel adjacent to the OUTSIDE CORNER.

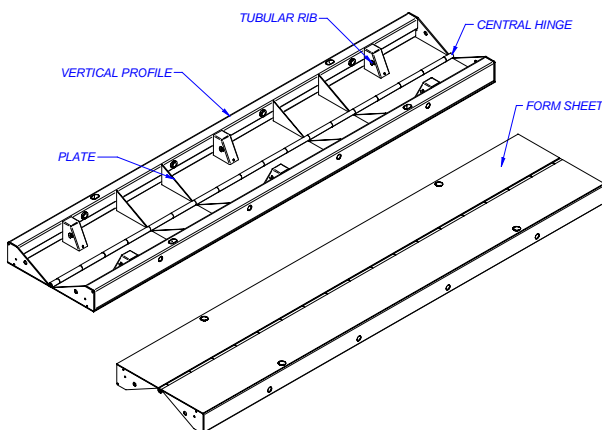


## 2.14. ORMA HINGED INSIDE CORNER 3.3-2.7-1.2

These elements are used on the inside face of the hinged corners.

They are comprised of a completely metal panel formed by two symmetrical parts, which pivot around a central hinge. These parts are comprised of form sheet with a vertical external profile, rectangular tubes with drill holes reinforced by bushings and reinforcement plates.

The vertical external profile has holes where the TIE RODS can be inserted and side holes that are reinforced with bushings.

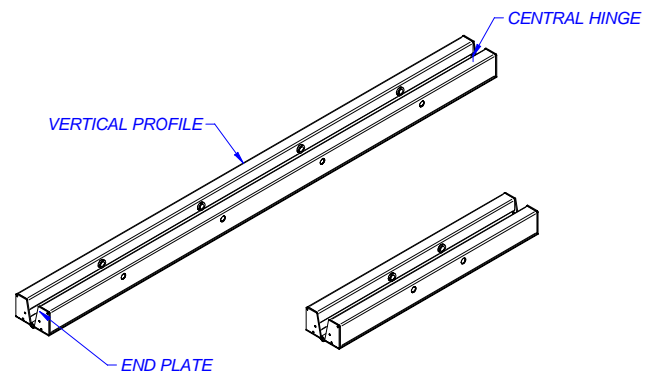


## 2.15. ORMA HINGED OUTSIDE CORNER 3.3-2.7-1.2

These elements are used on the outside face of obtuse or acute wall corners.

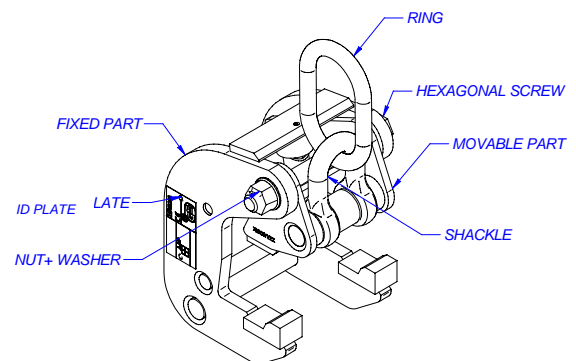
They are comprised of a completely metal panel formed by two symmetrical parts, which pivot around a central hinge. These parts are comprised of form sheet with a vertical external profile and reinforcement plates on the ends.

They do not have holes where the TIE RODS can be inserted.



## 2.16. ORMA LIFTING HOOK

The ORMA LIFTING HOOK is an auxiliary component of the ORMA formwork system used for lifting single panels or gangs with a crane.



The lifting hook is designed for a maximum working load of 1500 kg.

As a general rule, a minimum of two hooks must be used for lifting panels or gangs.

## 2.17. ORMA CLAMP

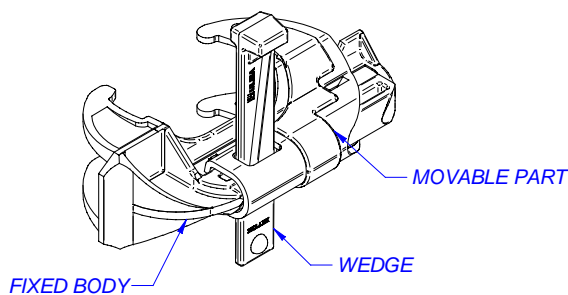
The ADJUSTABLE CLAMP is the main component used to join and fix ORMA system elements.

It is used to join different panels together to form the desired assemblies, always assuring concrete leak tight joints. Panel's joint can be made horizontally or vertically.

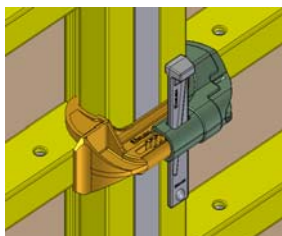
The clamp is comprised of three different parts: fixed body, movable body and wedge.

The movable body slides on the fixed body until the desired opening is achieved. In this position, the wedge is stroken with a hammer until the clamp joins both external profiles together.

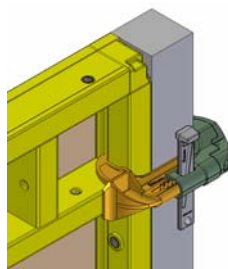
SAFE WORKING LOAD: 20 kN



It can join wooden or steel fillers of up to 100mm, placed between two adjacent panels.



maximum compensation  
between panels: 10cm



maximum compensation  
in the extreme union of  
the panel: 16cm

## 2.18. ORMA FIXED CLAMP

The FIXED CLAMP is an ORMA system joining element. It does not have any stiffening capacity, so it almost always assembled with WALERS in the horizontal joints. It is used to join together different panels to form the desired assemblies, always assuring concrete leak tight joints.

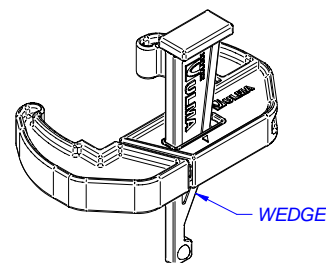
This joint can be made horizontally or vertically.

The clamp is comprised of three different parts: fixed body, movable body and wedge.

The movable body slides on the fixed body and the wedge is fixed in position with a hammer. The wedge cannot be lost due to a safety rivet.

This clamp can be only used to join panels without any filler between them.

WORKING LOAD: 15 kN

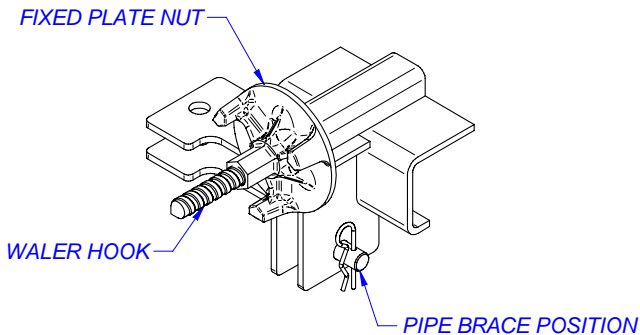


## 2.19. HEAD 60

This element is used as a connection between the panel and the push-pull props in order to stabilize the gangs.

It can be assembled on any hole in the rectangular tubes, vertically or horizontally.

The hook is inserted in any hole in the panel's ribs, and then the fixed plate nut is tightened over the head, thus securing it to the panel.



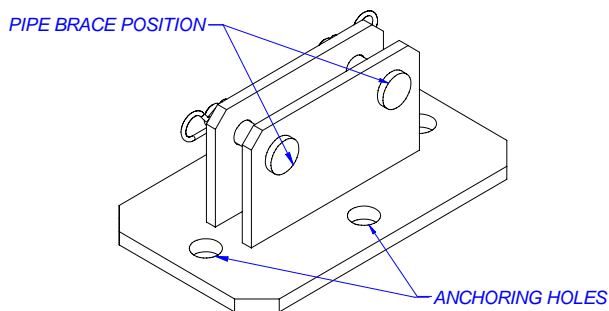
This head includes safety pins and cotter pins to fix the PUSH PULL PROP.

## 2.20. PUSH-PULL PROP SHOE

The PUSH-PULL PROP SHOE is the component used to anchor PUSH-PULL PROPS to the ground.

It has two plates with holes in which the PUSH-PULL PROPS are secured using pins, and a base plate is welded to these two plates.

This piece must be fixed on the foundation using the Ø21mm holes in the base plate in which necessary anchors are inserted.



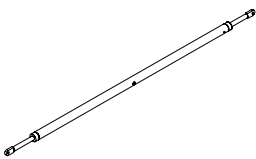
This element includes safety pins and cotter pins to fix the PUSH PULL PROP.

## 2.21. PUSH-PULL PROPS

PUSH-PULL PROPS are elements used in the assembly process to stabilize the panels against wind loads and to plumb the assembled gang or panels. They work under tensile and compression loads.

These pieces are formed by a tubular body with two adjustable screws located at each end in order to control the final length.

Depending on the formwork height, the appropriate PUSH-PULL PROP or combination of push-pull props will be used.

CODE	NAME	WEIGHT (kg.)	
1900134	Push-pull prop 1.1-1.7	7.8	
1900123	Push-pull prop 2.4-3.5	24.2	
1908168	Push-pull prop 3.6-4.8	43.3	
1900147	Push-pull prop 5-6	51	

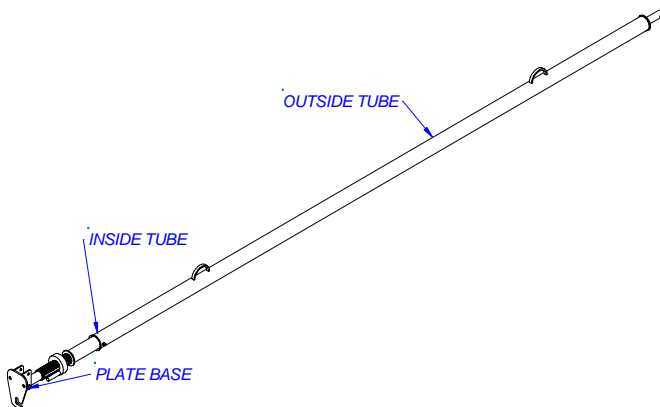
The push-pull props will be secured with pins to HEAD 60 on one side (this head will be fixed to the panel) and to the PUSH-PULL PROP SHOE on the other.

## 2.22. PUSH-PULL PROP 6-10

The PUSH-PULL PROP 6-10 and the PUSH-PULL PROPS have the same function, i.e., to stabilize the panels against wind and to plumb the high panel assemblies. They work under tensile and compression loads.

As indicated by the name, lengths range from 6m to 10 m.

The PUSH-PULL PROP 6-10 is an adjustable prop composed of outside and inside tube that incorporates a base plate on its bottom to anchor it to the ground.



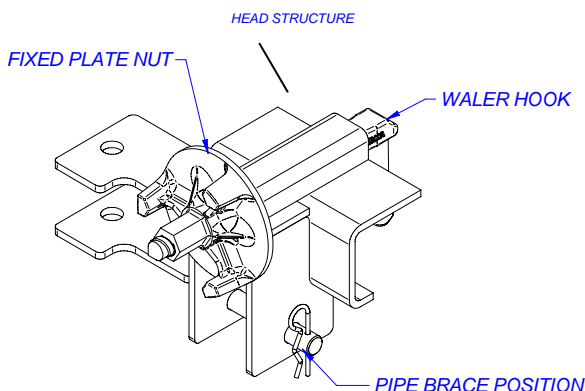
### 2.23. PROP HEAD

The PROP HEAD is used to connect the panel and the PUSH-PULL PROP 6-10 in the process of stabilizing the panels.

This head is fixed to the free end of the PUSH-PULL PROP 6-10 using the pin and cotter pin.

It can be inserted in any hole of the vertical or horizontal ribs.

The hook is inserted in any hole of the panel's rectangular tubes and then the fixed plate nut is tightened over the head, thus fixing the prop head to the panel.



This head also includes safety pins and cotter pins to fix the PUSH PULL PROP.

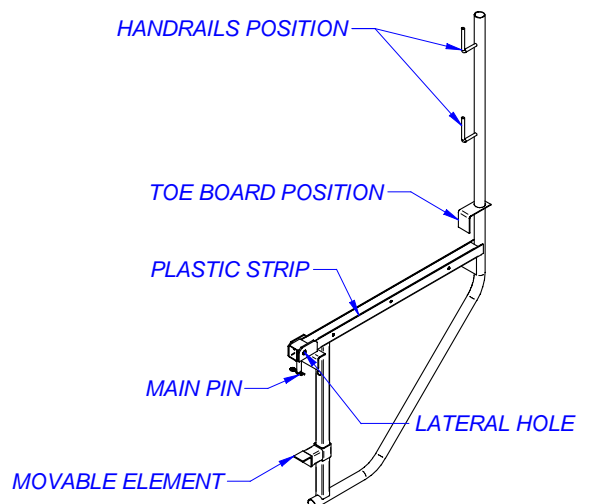
### 2.24. ORMA WALKWAY BRACKET

The WALKWAY BRACKET is used to build the walkway platform where the concrete pouring or any other job will be executed over the formwork.

It has fixing elements for securing plank based handrails and toe boards. Planks are nailed to a plastic strip located on the base, thus creating the work platform.

The bracket is installed by inserting the main pin in one of the horizontal rib holes securing it with the cotter pin and resting the movable stop on the lower rib, to provide stability. The bracket can be also assembled on the vertical ribs through the lateral holes, securing it with the PANEL BOLT and HEXAGONAL NUT 15 or with SHORT PIN 0.35 and two HEXAGONAL NUTS 15.

This bracket includes a safety cotter pin, located in the main pin, to avoid safety problem during lifting the formwork.

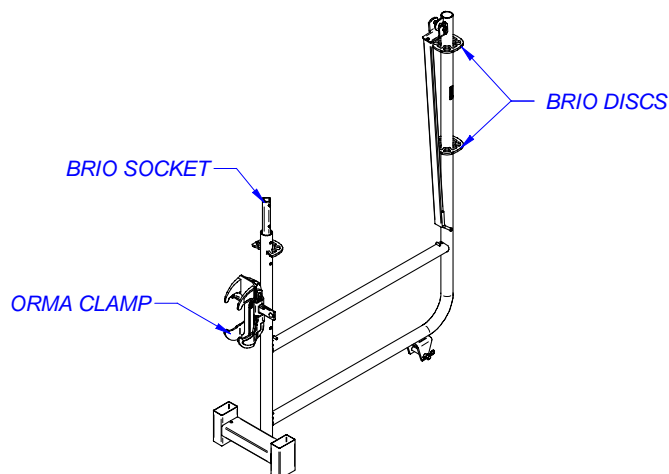


### 2.25. ORMA-BRIO BRACKET

The ORMA-BRIO BRACKET is used to build the walkway platform where pouring or any other job will be executed over the formwork.

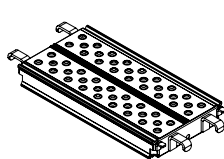
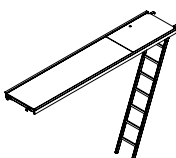
The difference between this and the standard BRACKET is that, in this case, the working area will be set up using standard BRIO scaffolding platforms rather than planks.

It includes several BRIO discs used to adapt the horizontal ledgers between brackets, thus creating the safety handrails.

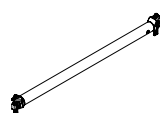


This bracket can be placed on top of the formwork; in that case, it must be fixed using the TYING PROFILE, or it can be placed in the horizontal panel joint, fixed on the profiles by the clamp welded on the end of the part.

List of BRIO Platforms that can be used with the ORMA-BRIO BRACKET

CODE	NAME	WEIGHT (kg)	
2127718	Platform 0.7	6.6	
2127717	Platform 1.02	9	
2127716	Platform 1.5	12.4	
2127715	Platform 2	17	
2127714	Platform 2.5	20.2	
2127713	Platform 3	22.2	
2127868	Platform with ladder 2	18.6	
2127712	Platform with ladder 3	31	

These are the BRIO ledgers that can be used with the ORMA-BRIO BRACKET.

CODE	NAME	WEIGHT (kg)	
2127522	Ledger 0.7	3.2	
2127523	Ledger 1.02	4.4	
2127524	Ledger 1.5	6	
2127525	Ledger 2	7.6	
2127526	Ledger 2.5	9.4	
2127527	Ledger 3	11.6	

The final position of the ORMA-BRIO BRACKET in the panel comes determined by the clamp incorporated in the bracket. This clamp, like any clamp, can be placed in certain positions of the panels.

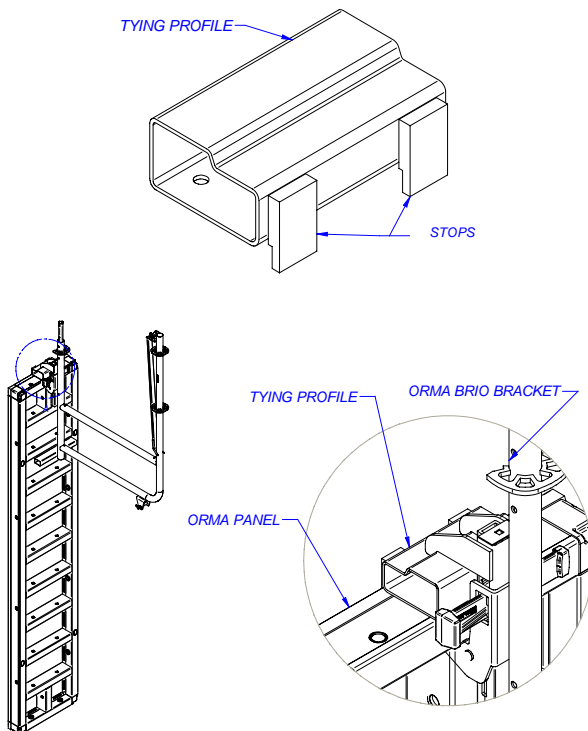
CODE	NAME	WEIGHT (kg)
2067035	Extending platform 1-1.5	12.5
2067048	Extending platform 1.5-2.35	17.3
2067043	Extending platform 2-2.5	20.5

## 2.26. TYING PROFILE

This is always used with the ORMA-BRIO BRACKET when the bracket has to be placed on the top part of the formwork.

It is a piece of BIRA profile, which together with the panel frame profile forms an assembly used to secure the ORMA BRIO BRACKET using the clamp welded on it. Additionally, it has two stops on the side of the form face.

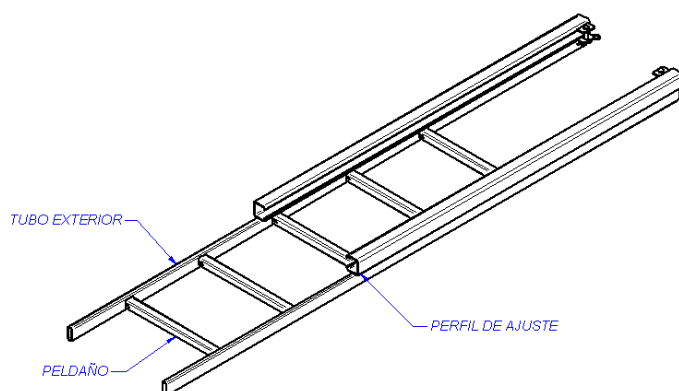




## 2.27. LADDER SUPPLEMENT

It is formed by outside tubes, steps and profiles for adjustment. It is used to increase the length of the LADDER incorporated in the BRIO platform.

Its use is necessary when the height between platforms mounted on the ORMA-BRIO BRACKETS is higher than 2.4m.



## 2.28. ORMA PLATFORM 2.4X1.2

This component is used as a working platform for pouring concrete when building walls. It serves the same purpose as the walkway brackets.

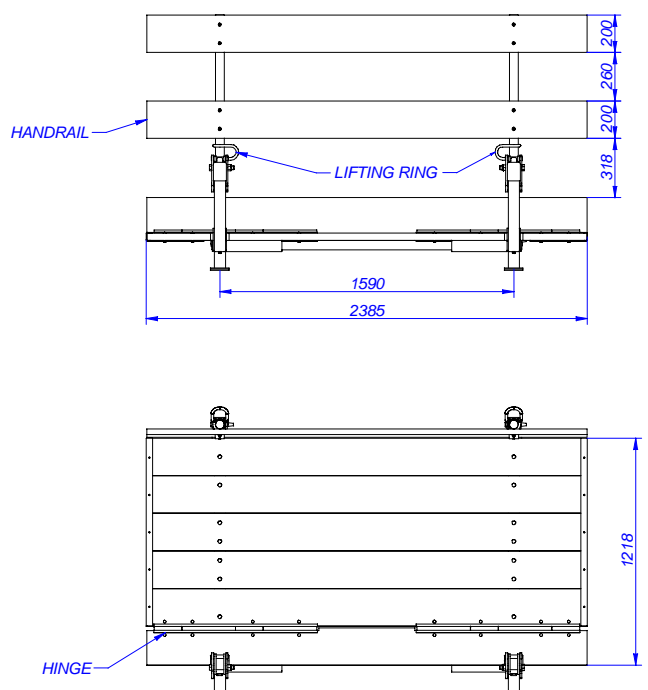
It is always placed on the top part of the ORMA formwork panel, as much if the panel is in vertical or horizontal position, and it is ideal for straight geometries, without corners, pilasters, etc.

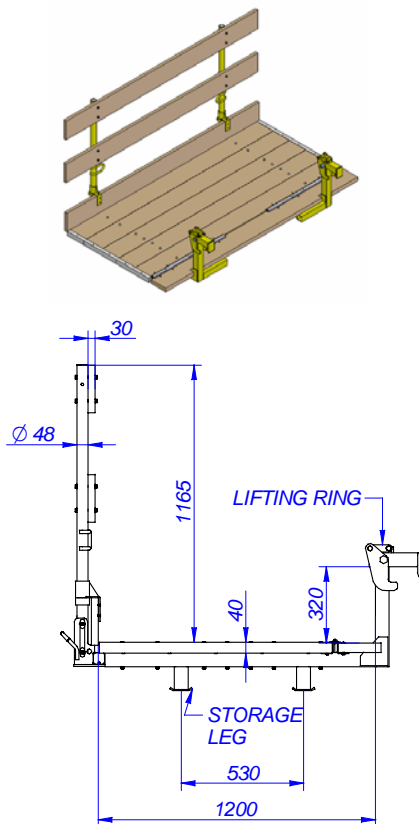
It is a metal structure to which 20cmx4cm wooden planks are screwed in to form the base of the working platform.

The fixing system to the panel is included in the front part of the platform. It has a hook that can be pulled to automatically open the lock plates. Upon releasing the hook, said plates will close on the ORMA panel profile.

Note that the work platform base is always approximately 30cm below the top of the panel.

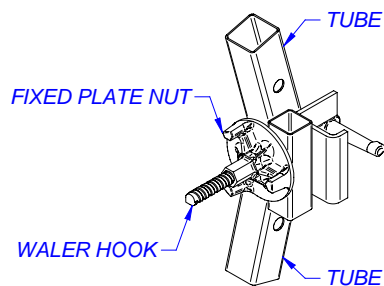
Likewise, tubes are installed on the rear of the platform with pins and several 20x3cm planks are screwed to these. Accordingly, the safety handrail and toe board are formed





## 2.29. POST BRACKET

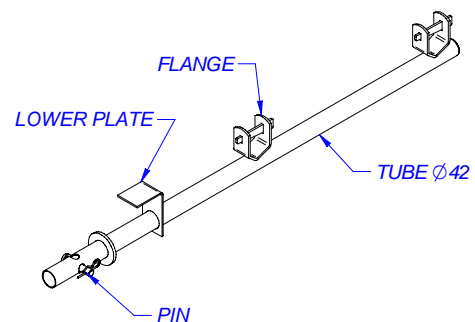
The POST BRACKET is a support component on which the SAFETY HANDRAIL POST SV is inserted to provide protection (handrail) on the opposite side of the WALKWAY BRACKET or PLATFORM 2.4x1.2. Thus, it is positioned in front of the work-pouring area.



It is composed of rectangular tubes where the SAFETY HANDRAIL POST SV is anchored, and it has a WALER HOOK with a SAFETY FIXED PLATE NUT. This bracket can be secured in the holes of the ribs, inserting the hook and securing it with the FIXED PLATE NUT.

## 2.30. SAFETY HANDRAIL SV

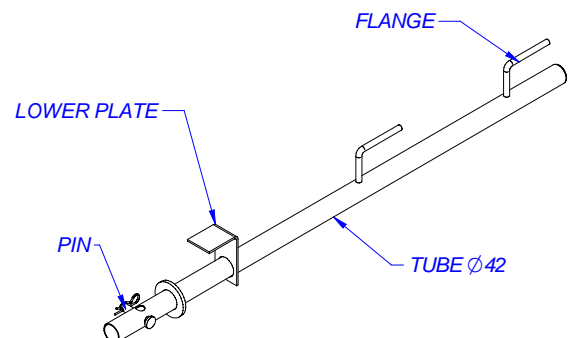
This is an element composed of a round vertical tube that is assembled on the POST BRACKET using the pin incorporated in the post. Several flanges are also welded on the piece for attaching D42 tubes to create handrails and a lower plate for the toe board, thus front side protection is provided.



This post includes safety pin and cotter pin to fix it to the POST BRACKET.

## 2.31. SAFETY HANDRAIL POST

This is an element composed of a round vertical tube that is assembled on the POST BRACKET using the pin incorporated in the post. Several flanges are also welded on the piece for attaching planks to create handrails and a lower plate for the toe board, thus front side protection is provided.



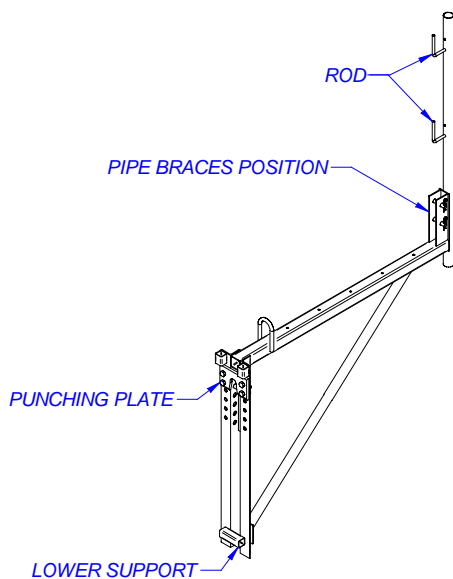
This post also includes safety pin and cotter pin to fix it to the POST BRACKET.



## 2.32. ORMA CLIMBING BRACKET

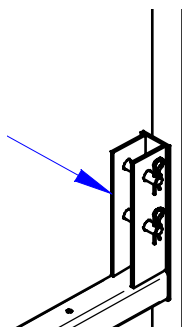
This component is used to build walls that are not on ground level. It is the element that supports the formwork panels when it is necessary to build high walls in different phases.

For climbing, it is possible to use cones, climbing rings and screws that can be placed on the TIE ROD positions or over the plywood.



It has a punched plate in the front part that permits placing the CLIMBING BRACKET at the required height. The bracket also includes rods to assemble safety handrails with planks, and it has components where PUSH-PULL PROPS can be placed to stabilize the formwork.

This element includes safety pins and cotter pins to fix the PUSH PULL PROP to the bracket

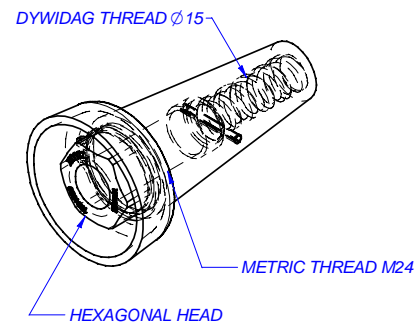


## 2.33. CONE DW15/M24

This element is used for climbing walls with the LOST TIE ROD, always joined to the CLIMBING RING NT15 and the HEXAGONAL BOLT M24x120 DIN931-10.9.

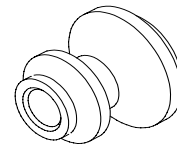
It is a metal piece with two different internal threads: half is metric thread M24 and the other half is the Dywidag type. Thus, it permits threading tie rods DW15mm.

This piece can be recovered from the wall after stripping the formwork. For this purpose, it has a 36mm hexagonal head used to extract the cone from the wall.



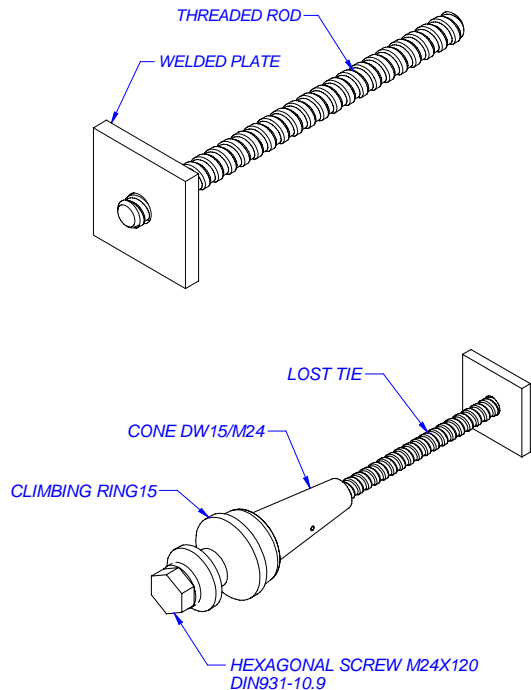
## 2.34. CLIMBING RING NT 15

The CLIMBING BRACKET is supported on this element, which is installed over the CONE DW15/M24 connected to the same by a HEXAGONAL BOLT M24X120 DIN931-10.9.



## 2.35. LOST TIE 15/0.25

This piece is composed of a tie rod with a plate welded on its end. It is used for climbing with the cone system when said system is only set up on one side of the wall. In this case the piece is always lost in the concrete, and it cannot be recovered.

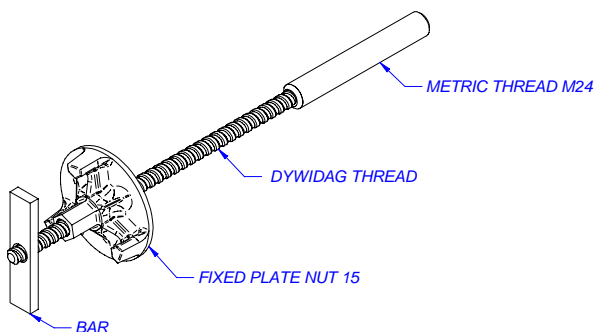


CLIMBING ELEMENTS SET

## 2.36. CONE-WALER CONNECTOR

This is a rod with metric threads M24 on one side and Dywidag threads on the other side. It includes a FIXED PLATE NUT that slides on the DW threads side. It also has a flat bar on the other end that is used as a stop for the FIXED PLATE NUT.

It is used to secure the climbing elements (cones, rods) on the panels by threading it through the holes provided for the TIE RODS.



## 2.37. ORMA WALER

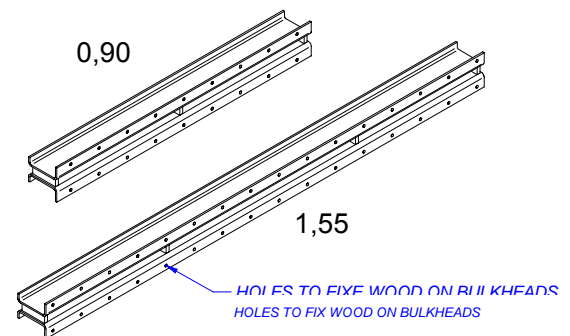
This component is available in two different lengths: 0.9 and 1.55 m, and its main function is to increase gang stiffness.

It is comprised of two "U" profiles separated by rectangular shims.

Depending on the height and the dimensions of the panels to be lifted, the appropriate waler is used. Both elements are always fixed to the panel with two WALER HOOKS.

WALERS will also be used for bulkheads and for aligning panels around fillers.

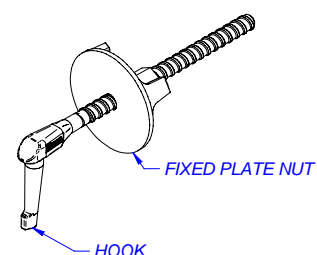
MAX. ADMISSIBLE MOMENT: 5,5 kNm



## 2.38. WALER HOOK

This is used to secure the WALERS to the panels. Two WALER HOOKS are used to tie each WALER.

It comprises a hook that is positioned over the holes in the ribs. The FIXED PLATE NUT incorporated in the component is used to tighten it over the WALER.



### 2.39. TIE ROD

This component, in conjunction with plate nuts, is used to support panel joints (one opposite the other), due to concrete pressures while pouring.


They are inserted through the panel's tie holes, and SPACER TUBES are used to sleeve the tie rods. The final tightening is made using corresponding nuts.

There are TIE RODS of Ø 15mm and Ø20mm.

TIE ROD 15mm  
SAFE WORKING LOAD: 90 kN

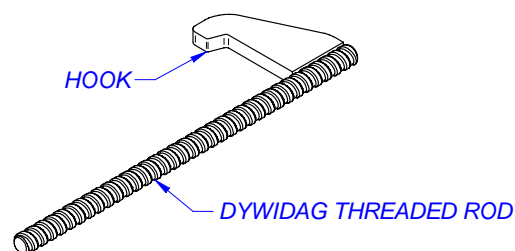
TIE ROD 20mm  
SAFE WORKING LOAD: 160 kN

Tie rods are available in the following lengths in order to cover different wall thicknesses.

CODE	NAME	WEIGHT (kg.)	
0230100	TIE ROD 15/1	1.7	
0230120	TIE ROD 15/1.2	2	
0230150	TIE ROD 15/1.5	2.2	
0230200	TIE ROD 15/2	3.3	
0230600	TIE ROD 15/6	10	
0234100	TIE ROD 20/1	2.9	
0234120	TIE ROD 20/1.2	3.4	
0234150	TIE ROD 20/1.5	4.3	
0234200	TIE ROD 20/2	5.2	
0234600	TIE ROD 20/6	17.2	

### 2.40. ORMA BULKHEAD HOOK


The bulkhead hook can be used along with the WALERS and PLATE WASHER NUT 15 when building bulkheads. It can be hooked over the panel lateral profile with the possibility of placing it in any position.



SAFE WORKING LOAD: 15 kN

### 2.41. PINS

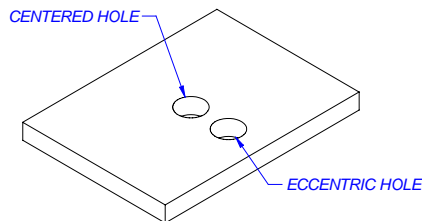
These are Ø15mm steel DW threaded rods that are used as auxiliary joint elements with the HEXAGONAL NUT 15 or PLATE WASHER NUT 15.

CODE	NAME	WEIGHT (kg.)	
1861033	SHORT THREADED ROD 0.35	0.6	
1861034	LONG THREADED ROD 0.55	0.8	

## 2.42. ECCENTRIC WASHER

The eccentric washer is a 150X110X12mm plate with two Ø20mm holes: one centered and the other not. It is always used with the HEXAGONAL NUT15 in place of the PLATE WASHER NUT 15 in conjunction with the TIE RODS.

This element is used when the panels are in horizontal position in contact with the ground so is not possible to place the PLATE WASHER NUT 15; The ECCENTRIC WASHER and the HEXAGONAL NUT is placed in the bottom row of ties.

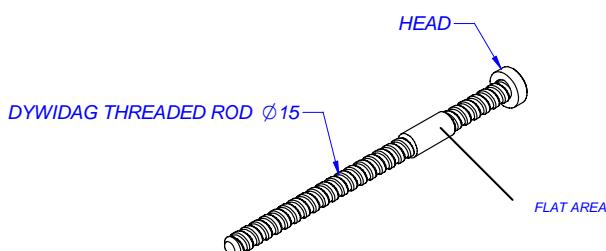


## 2.43. TIE BOLT

This element is used to make 90° connections between the PANELS COLUMN for forming columns. It also can be used in conjunction with WALERS to make bulkheads or 90° corners and bulkheads with the UNIVERSAL PANELS.

It is a threaded bolt with a round head, and it has a flat area with a large diameter to reduce slack and minimize the looseness inside the hole where the piece will be placed.

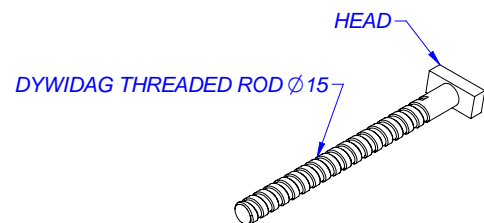
PLATE WASHER NUT 15 is always used as tying component.



## 2.44. PANEL BOLT

This element with the HEXAGONAL NUT 15 is used to fix the WALKWAY BRACKET, inserting the bolt through holes in the ribs when the panel is in a horizontal position (ribs in vertical).

It is formed by a tie rod with a head on one end.

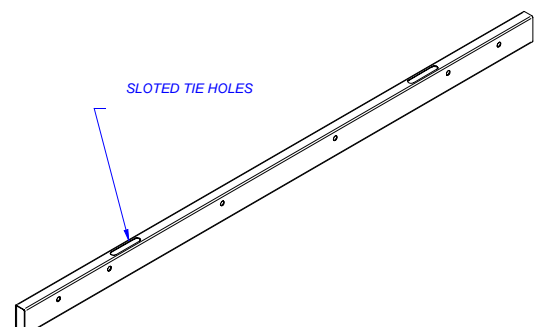


## 2.45. COMPENSATION TUBE 3.3-2.7-1.2

These are 120x50 rectangular tubes with wide front holes on the same level as the panels. They basically have two functions:

- They can be used as 5cm filler between panels in place of using wooden filler.
- They are used in inclined walls, when it is not possible to pass the TIE RODS through the panels (>6°). The tubes are placed between the panels and the TIE RODS pass through them instead through the panels.

The COMPENSATION TUBES can be joined laterally to the panels with SHORT THREADED ROD 0.35 and HEXAGONAL NUT 15.

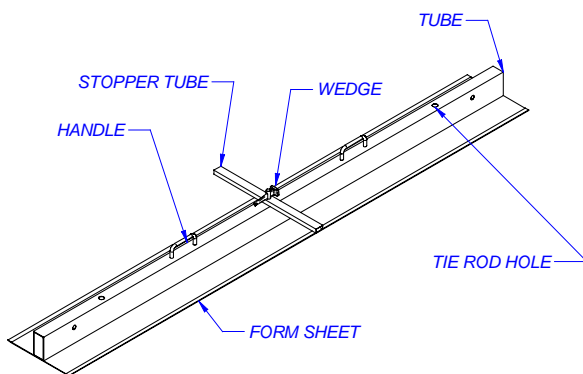


## 2.46. ORMA COMPENSATION

### PLATE 3.3-2.7-1.2

These are metal sheets that are used to provide filler between panels. They cover a 6-30cm wide range.

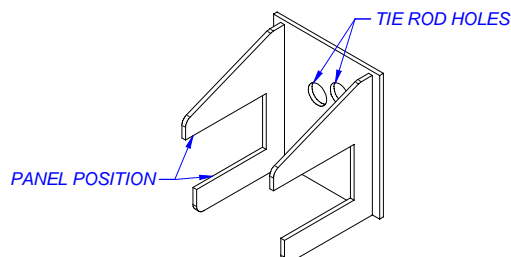
They are comprised of a form plate that has a tube welded in the center with holes for the TIE RODS. The plate includes a horizontal tube with a wedge in the middle, which is used to bring it into the same plane as the adjacent panels, and it has handles to facilitate the movement of the piece.



## 2.47. TOP TIE BRACKET 65

This element is always placed on the top of the formwork and fixed to the panel profile. It can be used to pass the TIE RODS above the formwork.

It is used for foundation solutions and in those cases when it is desirable to avoid the tie hole for the top tie in the wall.

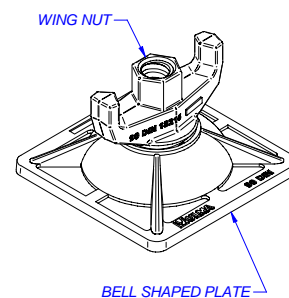


## 2.48. PLATE WASHER NUT 15

This element is formed by a 120x100mm "bell shaped" plate and wing nut, which allows the use of any Ø 15mm dywidag TIE RODS or PINS.

This element's shape makes it easy to use for straight or inclined walls, permitting an incline of up to 15°. It is capable to support the concrete pressures transmitted by ORMA PANELS.

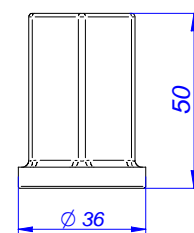
SAFE WORKING LOAD  
PLATE WASHER NUT 15: 90 kN



## 2.49. HEXAGONAL NUT 15

This 30mm (from one face to the opposite face) fastening element is 50mm long, and it accepts any 15mm TIE ROD or PIN.

SAFE WORKING LOAD  
HEXAGONAL NUT 15: 90 kN

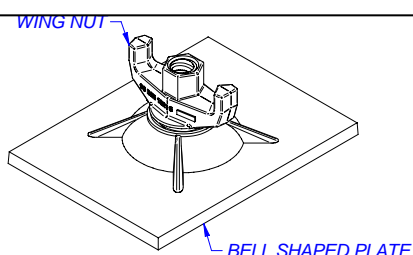


## 2.50. PLATE NUT D15 200X150

This is a tying element used together with the Ø 15mm TIE RODS.

It is used instead of the PLATE WASHER NUT 15 in those cases where the tie rods pass through 50-100 mm wide filler.

SAFE WORKING LOAD PLATE NUT  
200X150X10: 90 kN

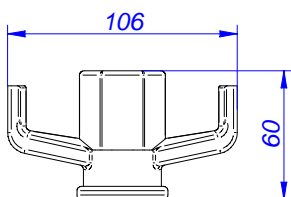


## 2.51. WING NUT 20

This fastening element can be used with any Ø 20mm TIE ROD.

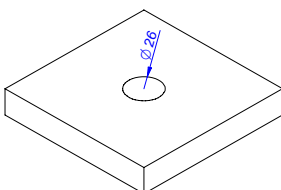
It is always used in combination with BASE PLATE D20.

SAFE WORKING LOAD  
WING NUT 20: 160 kN



## 2.52. BASE PLATE D20

BASE PLATE D20 and WING NUT 20 form the Ø 20mm TIE RODS tying elements.

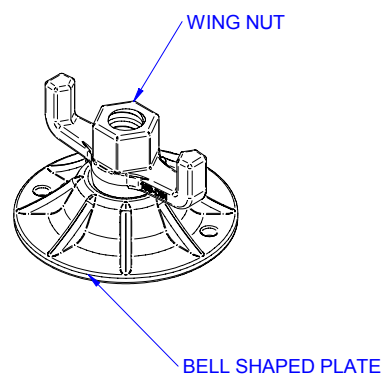


## 2.53. PLATE WASHER NUT 20

This element consists of a Ø 130mm "bell shaped" plate and a wing nut, and it can be used with any Ø 20mm TIE ROD.

This element's shape makes it easy to use for straight or inclined walls, permitting an incline of up to 15°. It is capable to support the concrete pressures transmitted by ORMA PANELS.

SAFE WORKING LOAD  
PLATE WASHER NUT 20: 160kN

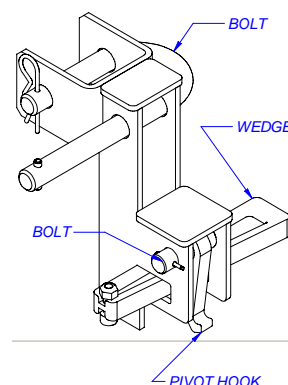


## 2.54. FOUNDATION HEAD

This piece is used to solve foundations and its function together with the FOUNDATION PLATE is to replace the lower tie rod.

It is comprised of a wedge and a hook that pivots on a bolt. This hook pulled by the wedge is used to fasten to the FOUNDATION PLATE.

It is always inserted in the panel's ribs holes and joined using the pin included with the piece.



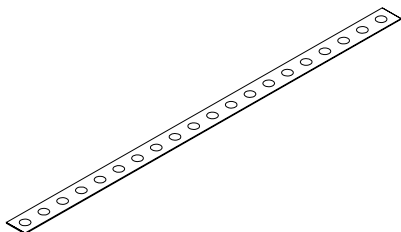
## 2.55. FOUNDATION PLATE

It is always used with the FOUNDATION HEAD and is the element that substitutes the tie rod in the base of the formwork.

It is a 2mm thick plate with holes of Ø22mm every 50mm, in order to achieve all standard wall thicknesses

The plate's working load is 12kN.

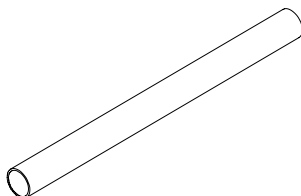
The FOUNDATION PLATE is lost in the concrete and cannot be recovered or reused.



## 2.56. SPACER TUBE 22/25

This element is a plastic tube used to sleeve TIE RODS 15, so ties can be easily recovered after stripping the panels.

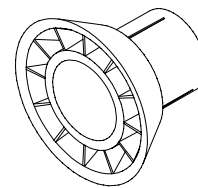
It is used to fix the thickness of the wall cutting it according to this distance and it always remains in the concrete



## 2.57. CONE 22

This element is a plastic cone. It is placed in both sides of the SPACER TUBE 22/25 and it will cover the panel tie hole. Together with the spacer tube, these two elements will form a wall spreader.

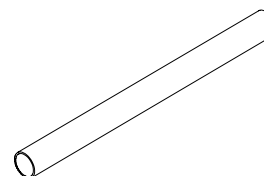
It can be easily extracted and reused.



## 2.58. SPACER TUBE 32/36

This element is a plastic tube used to sleeve TIE RODS 20, so ties can be easily recovered after stripping the panels.

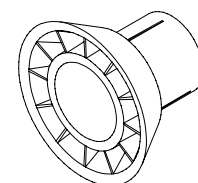
It is used to fix the thickness of the wall cutting it according to this distance and it always remains in the concrete



## 2.59. CONE 32

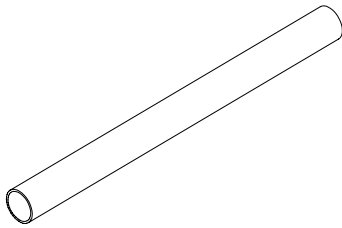
This element is a plastic cone. It is placed in both sides of the SPACER TUBE 32/36 and it will cover the panel tie hole. Together with the spacer tube, these two elements will form a wall spreader.

It can be easily extracted and reused.



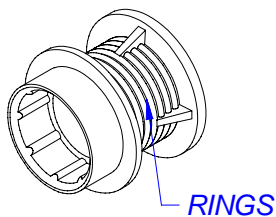
## 2.60. SPACER TUBE 22/26

This element is a plastic tube used to sleeve TIE RODS 15. It is used together with WATER STOP CAP 26 to solve "water stop" conditions in wall forming, for deposit or tank solutions.



### 2.61. WATER STOP CAP 26

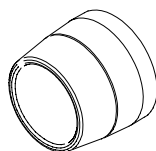
This plastic piece is manufactured with a series of cylindrical rings to prevent liquids from leaking through the wall. The element works together with PLASTIC PLUG 26 and SPACER TUBE 22/26 to assure the concrete leak tight seal of the holes left by the TIE RODS used for securing the formwork.



### 2.62. PLUG 20

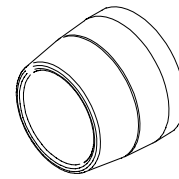
These are used to plug the holes not used for inserting TIE BOLTS in the PANELS "U" shaped tubes.

After stripping the panels, this plastic element is used to plug the holes in END CONES 22.



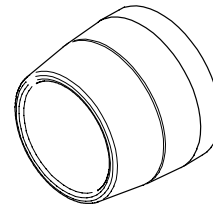
### 2.63. PLUG 22

After stripping the panels and removing END CONES 22, this plastic element is used to plug the holes in the SPACER TUBES 22/25.



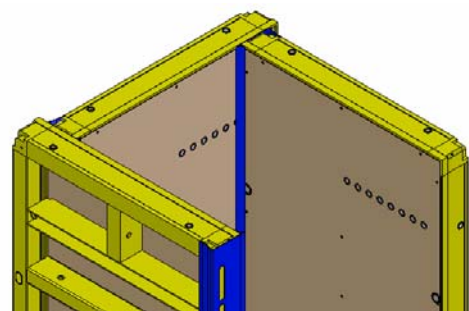
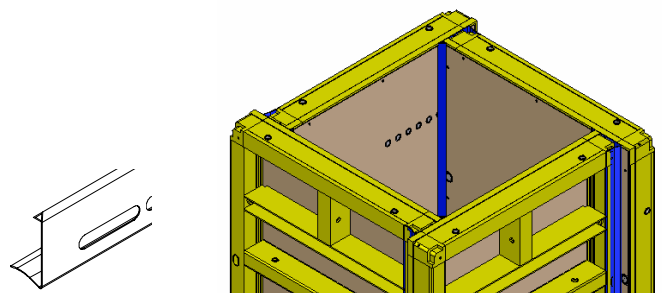
### 2.64. PLASTIC PLUG 26

This plastic element is used to plug the WATER STOP CAP 26 to solve the water stop condition in wall forming. It is placed after the formwork has been stripped.



### 2.65. ORMA CHAMFER 3.3M

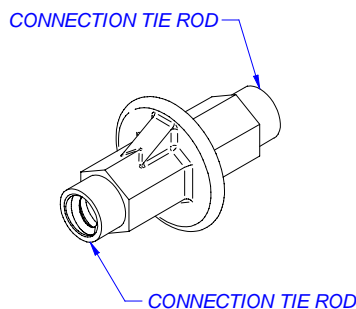
This is a plastic element used to do chamfers to the column corners. It is not necessary to use any additional element to tie the ORMA CHAMFER to the panel.





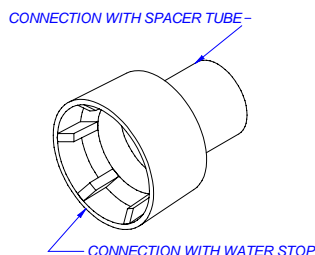
## 2.66. WATER STOP DW15

This metal piece is placed in the center of the wall and connected on both sides with TIE RODS. Its function is to provide a barrier to prevent the penetration of liquids to the inside of the wall.



## 2.67. WATER STOP ADAPTER DW15

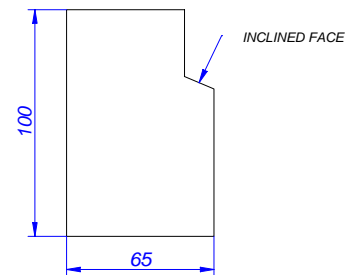
This plastic piece is always used together with the WATER STOP DW15, and it facilitates its connection with the standard SPACER TUBE 22 / 25. Together they protect the formwork TIE RODS.



## 2.68. WOODEN PROFILE 2.7 – WOODEN PROFILE 1.2

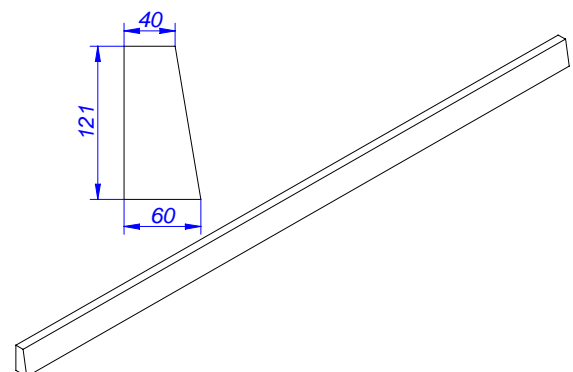
These are 2.7m and 1.2m long by 10cm wide wooden profiles. Similar to the frame's metal profile, they have an inclined face.

They are used to make customized wooden filler, placing two wooden profiles on the extremes of the filler and nailing a 21 mm thick piece of wood over them. They are clamped to the ORMA panels on the side, over the inclined face of the wooden profiles.



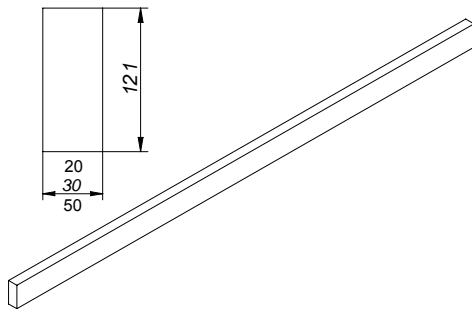
## 2.69. WOODEN BEVELED EDGE

This is a 3m long piece of wood with an inclined face. It is used to provide filler in areas where it is difficult to dismantle panels: elevator shafts, water tanks, etc. Two WOODEN BEVELED EDGES greased and joined face to face on their inclined faces should be used to make a miter joint, which facilitates posterior stripping. The filler will measure 100mm and it is placed on all the faces that are buttressed between corners. It is 3m long to assure that it will extend beyond the formwork (h=2.7). Said process begins by striking the zone that extends beyond the panels.



## **2.70. WOODEN FILLER**

These are 20, 30 and 50mm strips of wood used to provide filler from 20 to 100mm at a height of 2.70m. They can be used individually or grouped until the necessary thickness is achieved.



### 3. SOLUTIONS

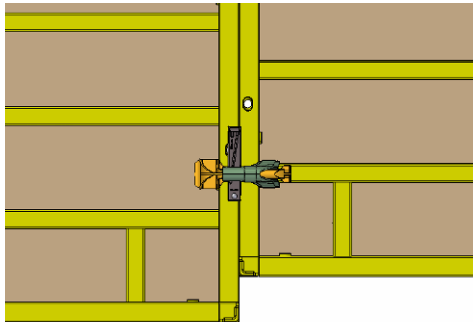
Gang solutions and solutions for different working cases are presented in the following sections:

- Panel assemblies-gangs
- 90° corners
- Hinged corners
- 90° Intersections
- Bulkheads
- Column forming
- Fillers
- Polygonal walls
- Adjoining wall forming
- Inclined walls
- Foundations
- Upper extra formwork
- Stripping in hollows
- Water Stop
- Climbing
- One face formwork

### 3.1. PANEL ASSEMBLIES-GANGS

Forming gangs with CLAMPS saves time during assembly because it is possible to set up by simply positioning the panels and tying them with the strike of a hammer.

Another important quality of this type of connection is that it allows the panels to be at different elevations because the CLAMPS can be placed anywhere along the panels' perimeter profiles.



#### 3.1.1 Vertical joint

The vertical joints can be made with both clamp models.

##### 3.1.1.1 Adjustable clamp

The vertical joints between panels are connected with two ADJUSTABLE CLAMPS in height:

\*Panel height 3.3 : 3 Clamps in each joint

\*Panel height 2.7 : 2 Clamps in each joint

\*Panel height 1.2 : 2 Clamps in each joint

Exceptions to this rule follow:

- The external joints in 90° corners between panels:

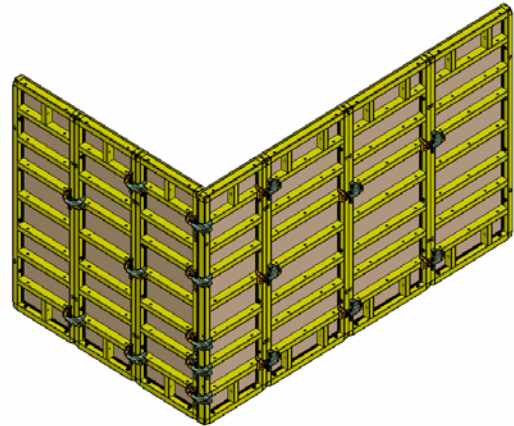
\*h = 3.3m: 7 Clamps

\*h = 2.7m: 5 Clamps

\*h = 1.2 m: 3 Clamps

- As a general rule, any joint adjacent to an outside corner should be reinforced with one more Clamp

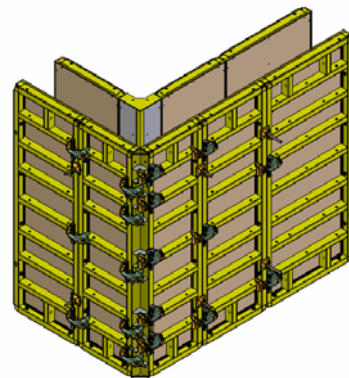
- Panel height 3.3: 4 Clamps in each joint
- Panel height 2.7: 3 Clamps in each joint
- Panel height 1.2: 3 Clamps in each joint



2.7 height Panel: 5 adjustable clamps in external joints in 90° corners, 3 adjustable clamps in the adjacent joint.

- The external joints in 90° corners with OUTSIDE CORNER:

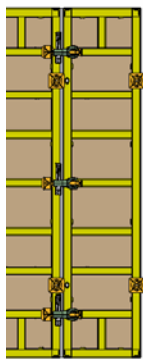
- OUTSIDE CORNER 3.3: 7 Clamps per each panel side.
- OUTSIDE CORNER 2.7: 5 Clamps per each panel side.
- OUTSIDE CORNER 1.2: 2 Clamps per each panel side.



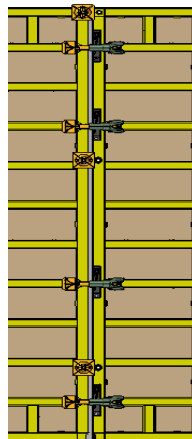
2.7 height Panel: 5 adjustable clamps per each side

- The joints with wooden filler between panels will have.

- Panel height 3.3: 4 Clamps.
- Panel height 2.7m: 3 Clamps.
- Panel height 1.2m: 3 Clamps.



Panel height 2.7m



Panel height 3.3m

- When possible, it is recommended to place always the Adjustable Clamp on the panels' rectangular tubes to achieve stronger joints.

### 3.1.1.2 Fixed clamp

As a general rule, the vertical joints between panels are connected with two FIXED CLAMPS in height:

- \*Panel height 3.3 : 3 Clamps in each joint
- \*Panel height 2.7 : 2 Clamps in each joint
- \*Panel height 1.2 : 2 Clamps in each joint

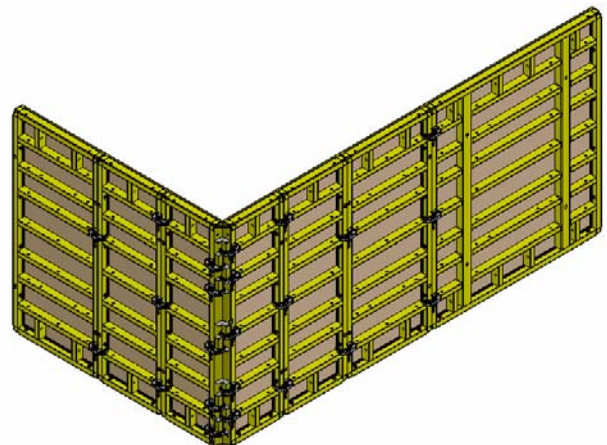
Exceptions to this rule follow:

- 4 clamps are placed in every vertical joint formed with a panel 3.3x2.4 and 3 with a panel 2.7x2.4.

- The external joints in 90° corners with OUTSIDE CORNER:

- OUTSIDE CORNER 3.3: 6 Clamps per each panel side.
- OUTSIDE CORNER 2.7: 5 Clamps per each panel side.
- OUTSIDE CORNER 1.2: 2 Clamps per each panel side.

- As a general rule, any joint adjacent to an outside corner should be reinforced with one more Clamp.



2.7 height Panel: 5 fixed clamps per each side of the OUTSIDE CORNER, 3 fixed clamps in the adjacent joint and 2 fixed clamps in the rest of vertical joints, except with the panel 2.7x2.4

- The external joints in 90° corners between panels cannot be made with that clamp.

### 3.1.2 Horizontal joint

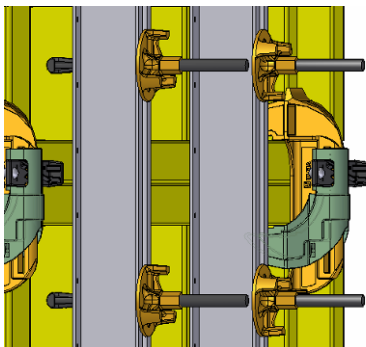
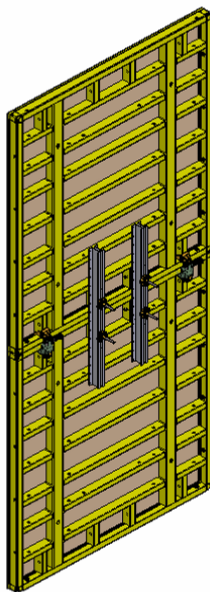
The horizontal joint is joined between panels when they are joined in height.

### 3.1.2.1 Adjustable clamp

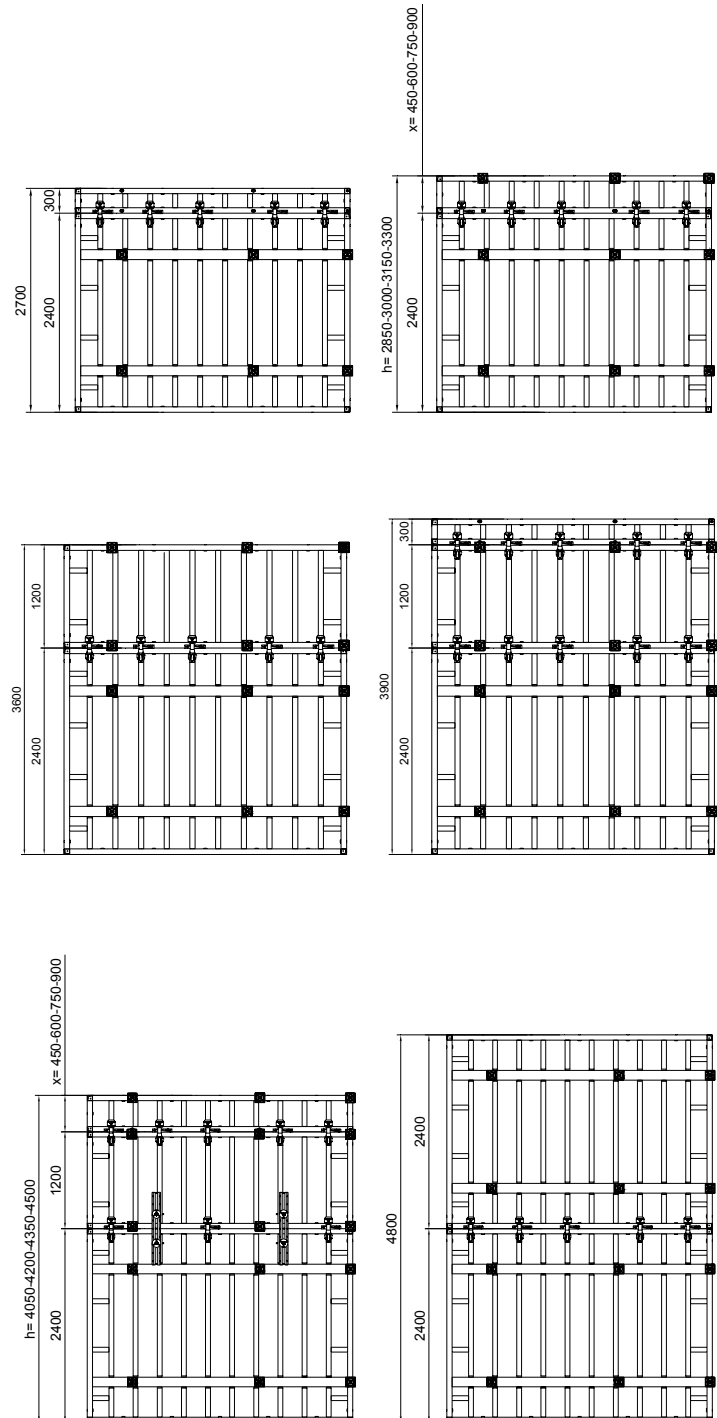
#### Range 3.3m and 1.2m

For this solution, depending on the panels sizes, only ADJUSTABLE CLAMPS or combination of clamps and WALERS is used.

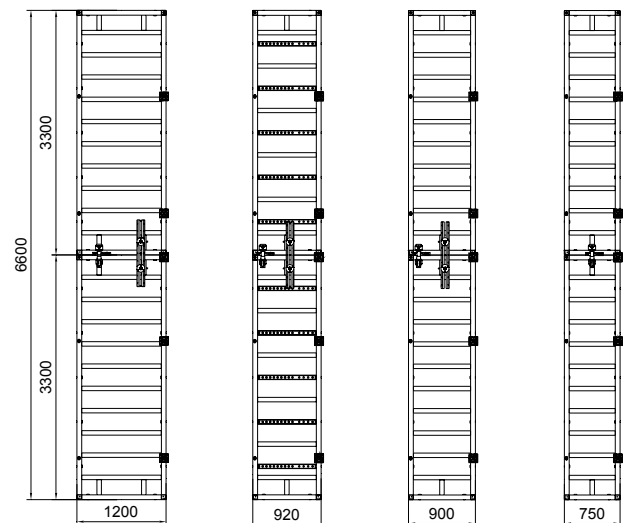
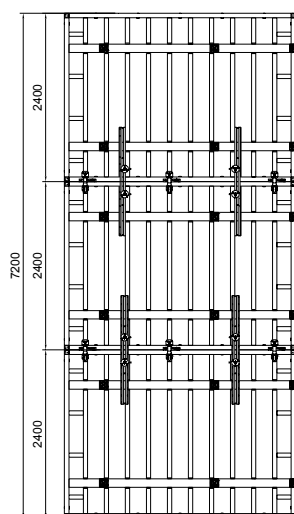
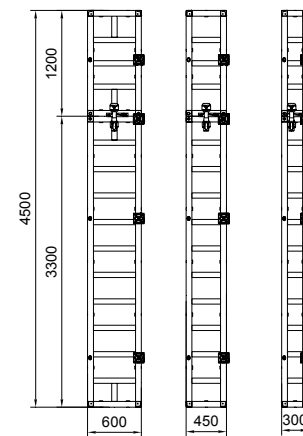
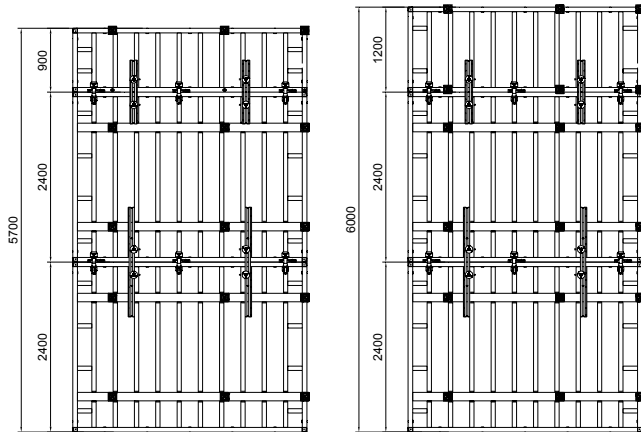
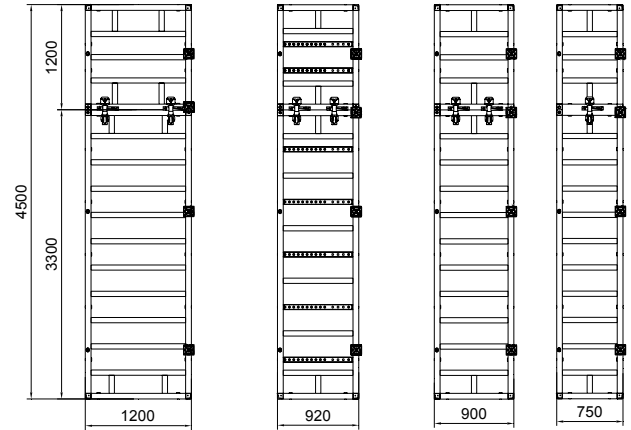
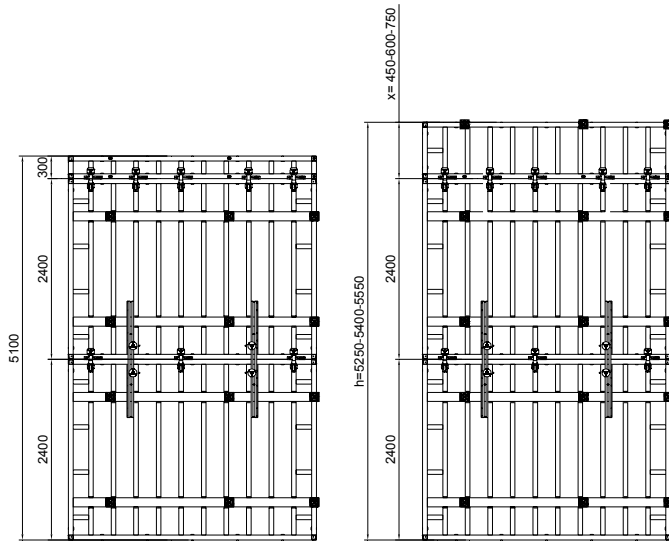
There are two types of WALERS: 0.90m and 1.55m. Both walers are fixed to the panel with two WALER HOOKS inserted in the tie holes in the rectangular tube.



**Detail: WALER fixing**

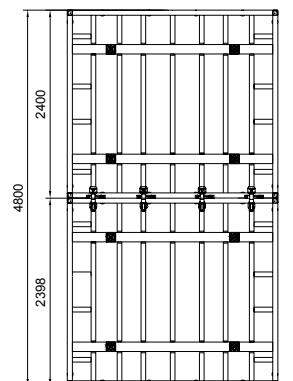
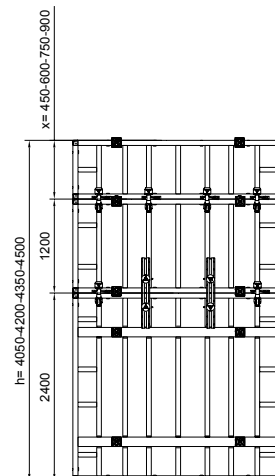
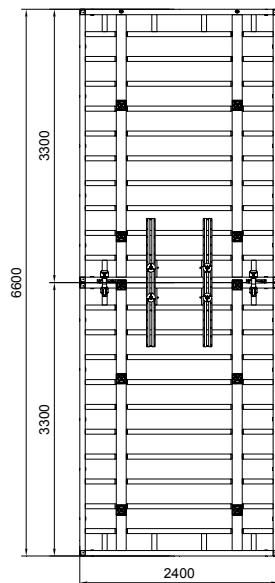
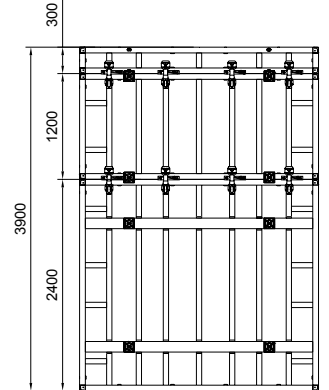
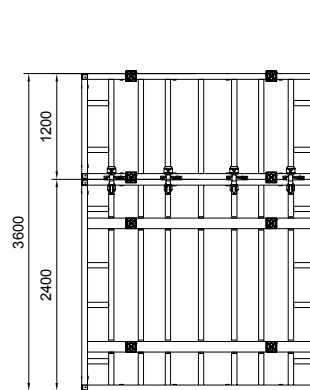
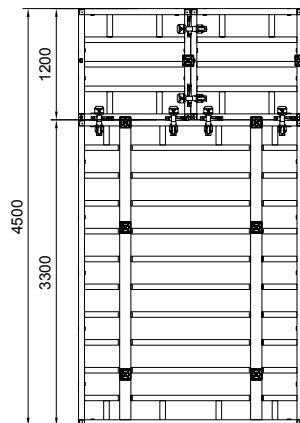
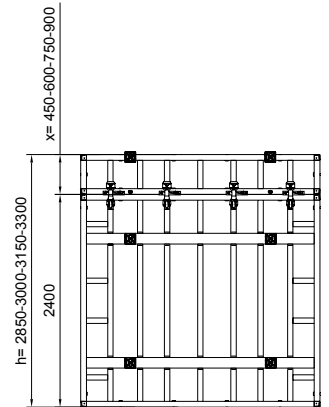
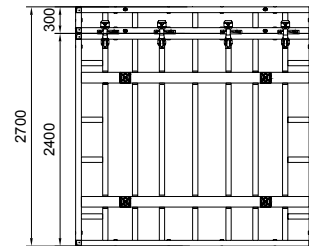
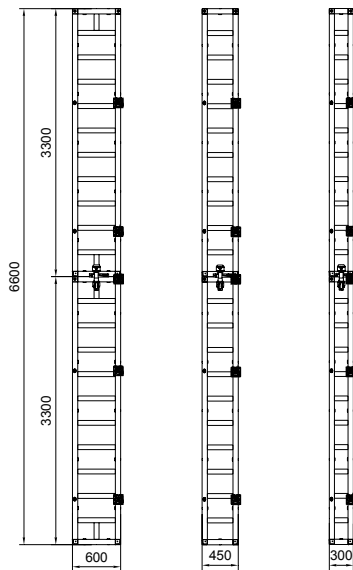


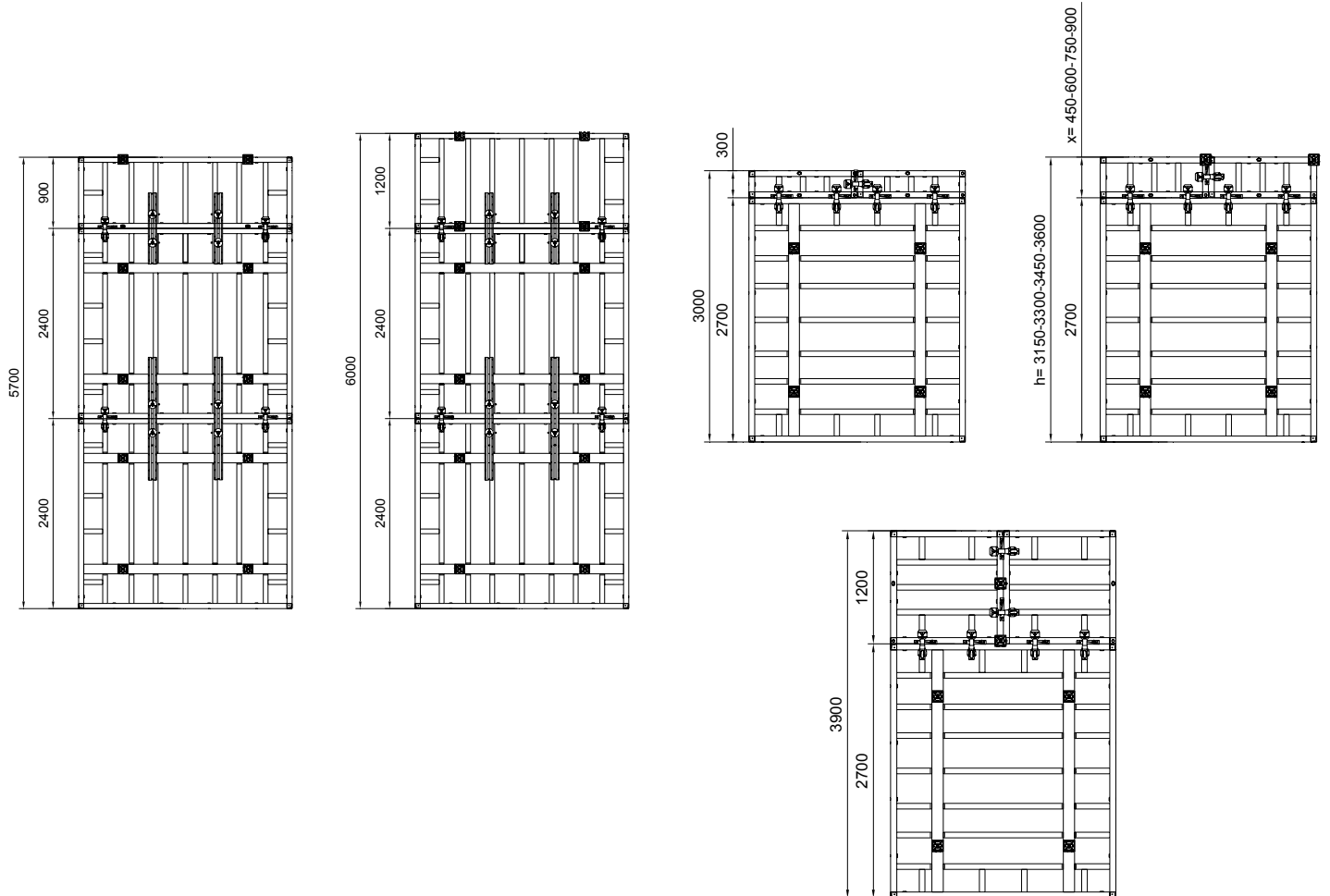
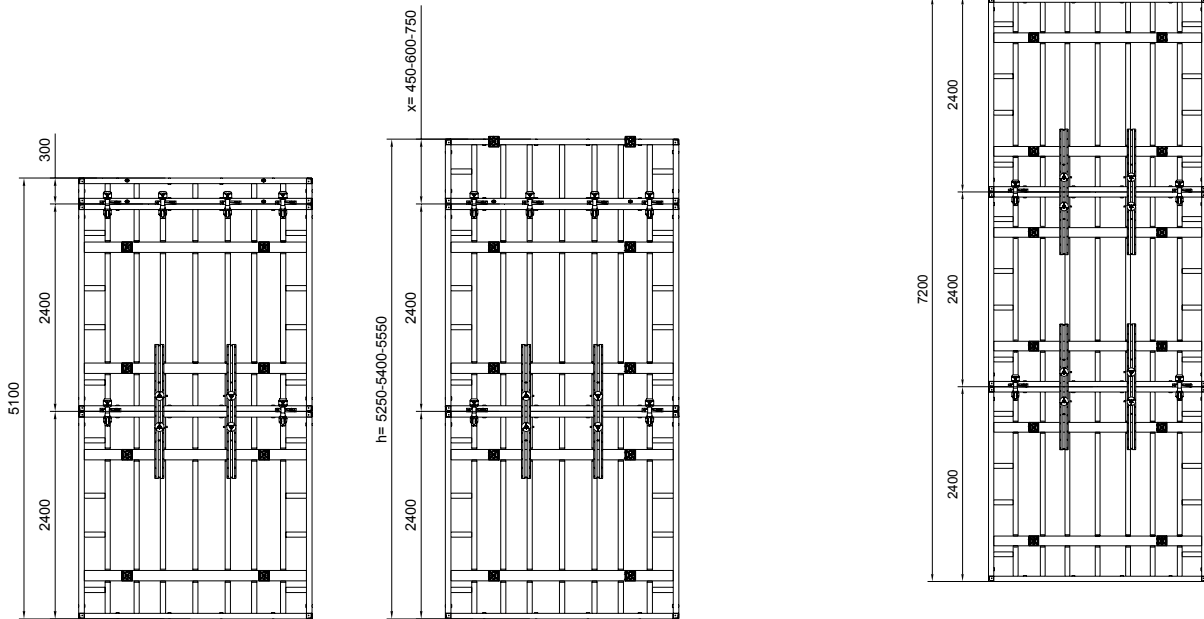
Some examples of different panel heights and gang elevations are provided here:

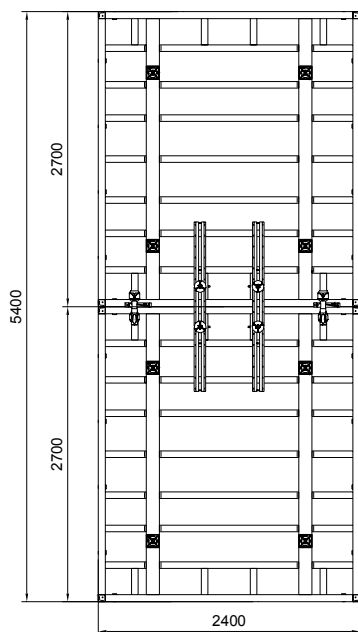
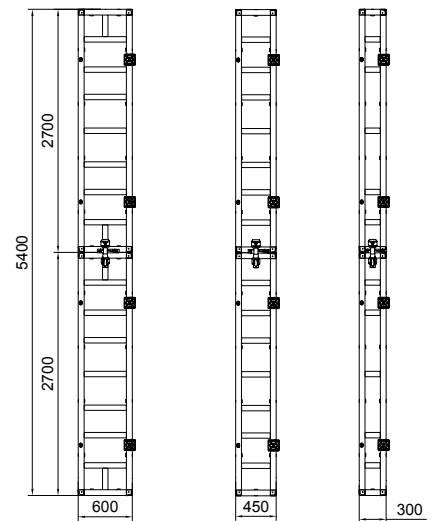
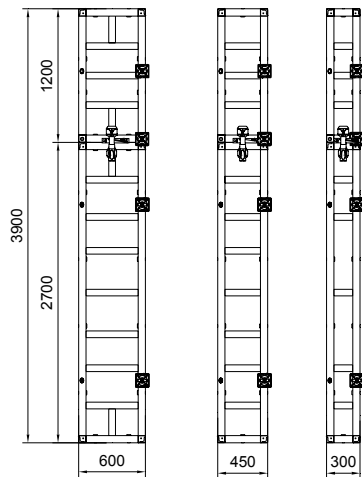
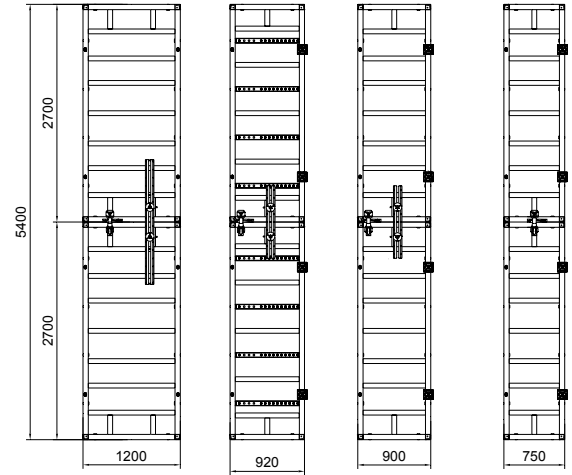
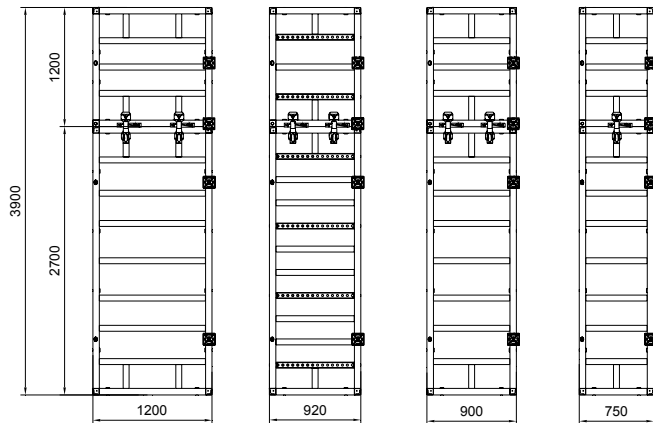


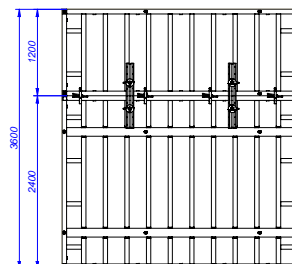
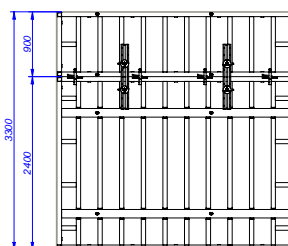
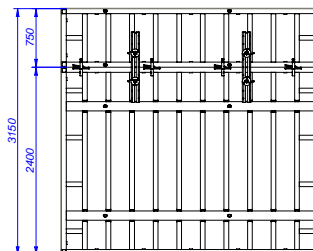
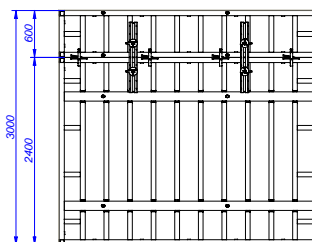
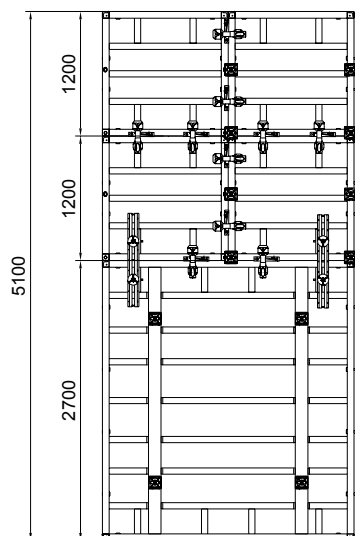


**range 2.7 and 1.2m**







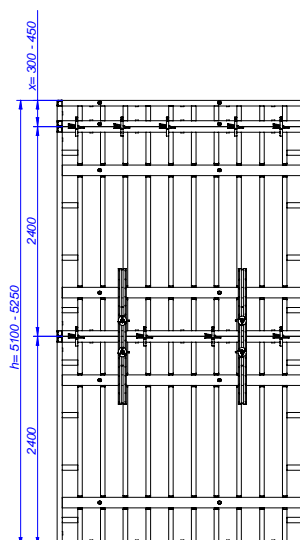
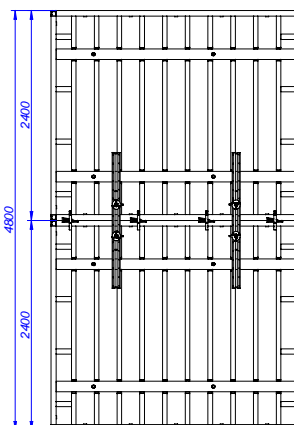
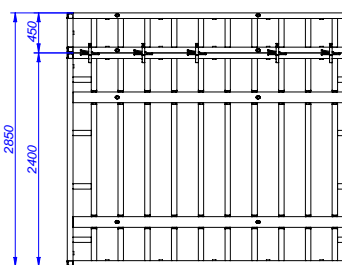
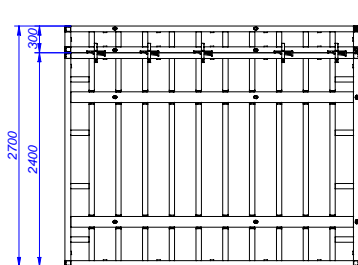
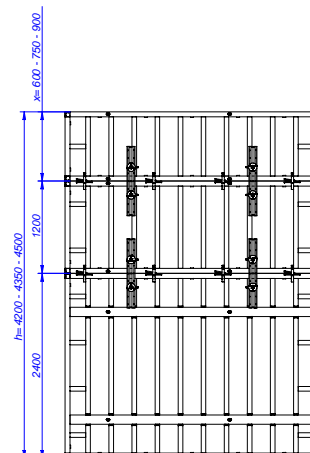
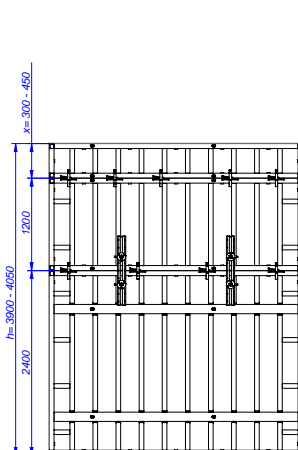


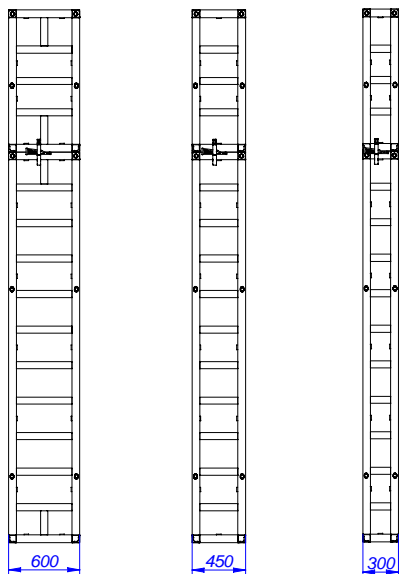
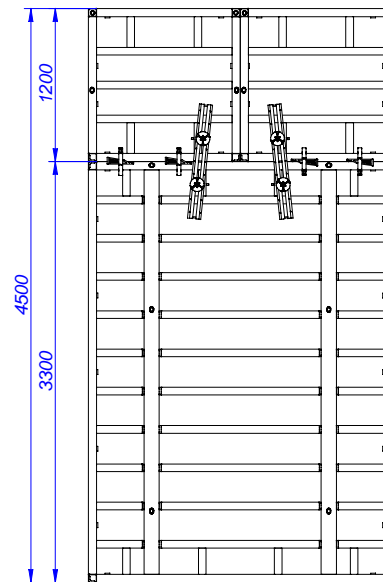
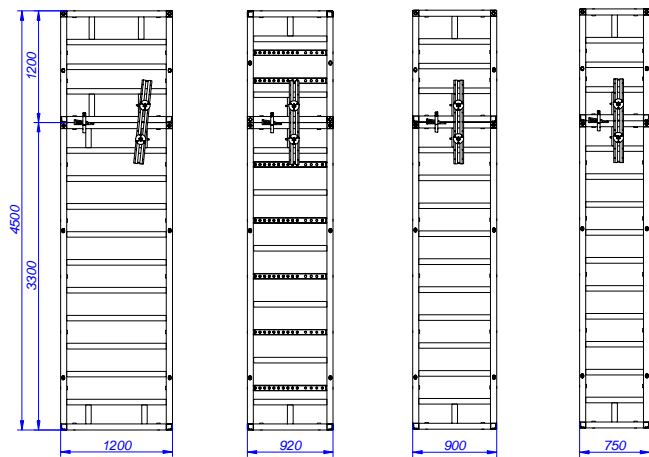
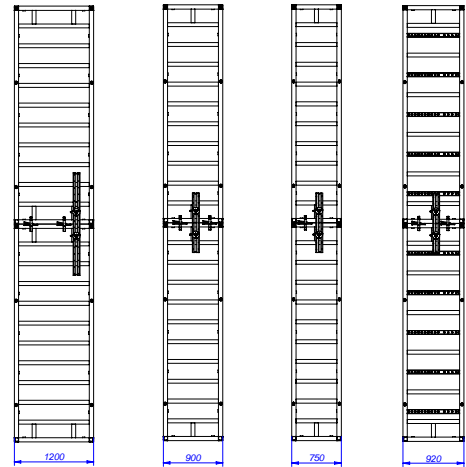
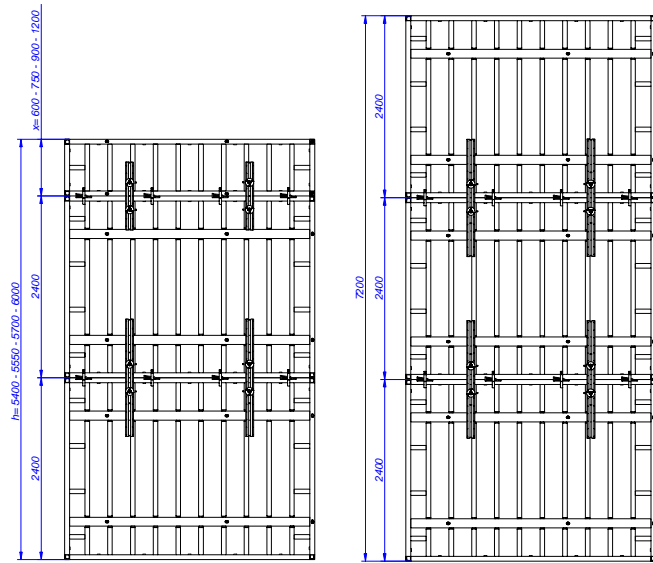
### 3.1.2.2 Fixed clamp

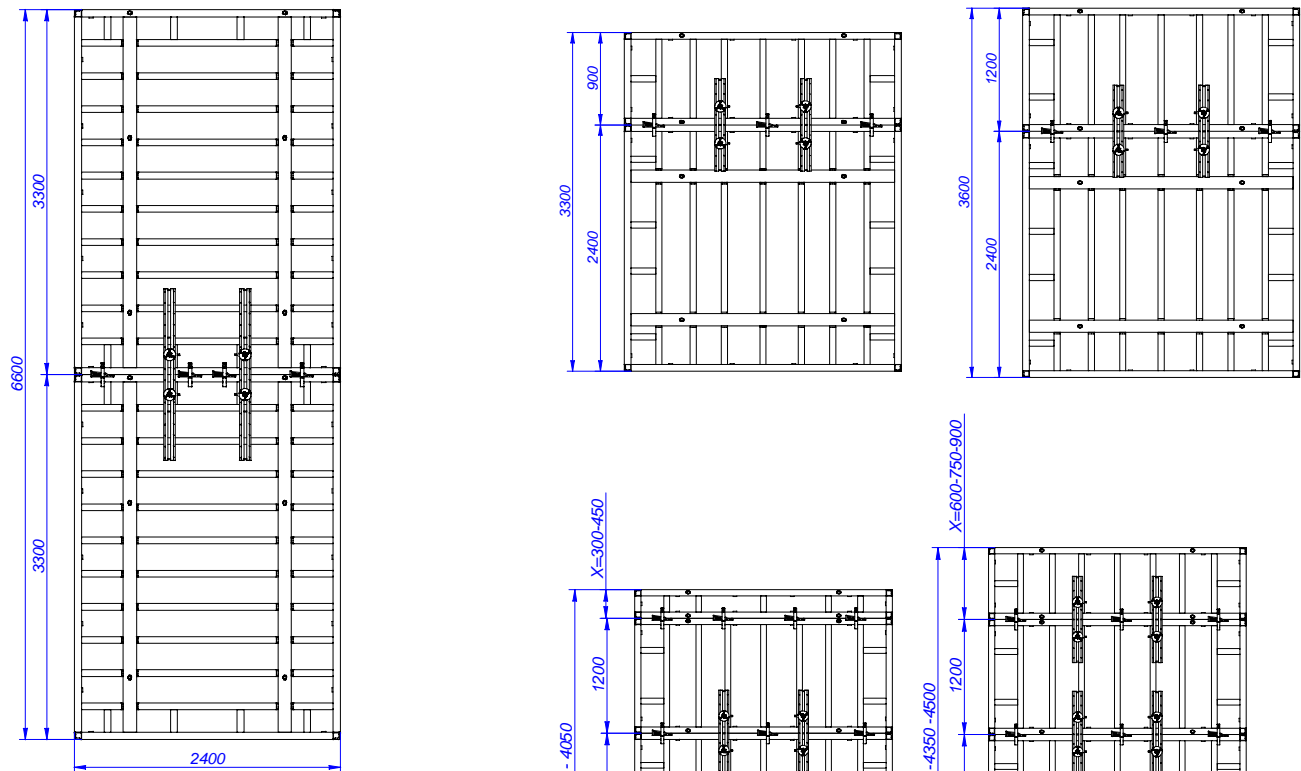
This element is placed on the profiles of the panels to join them. It does not have any stiffening capacity, thus it almost always will be assembled together with WALERS.

Following are some examples of different panel heights and gang elevations.

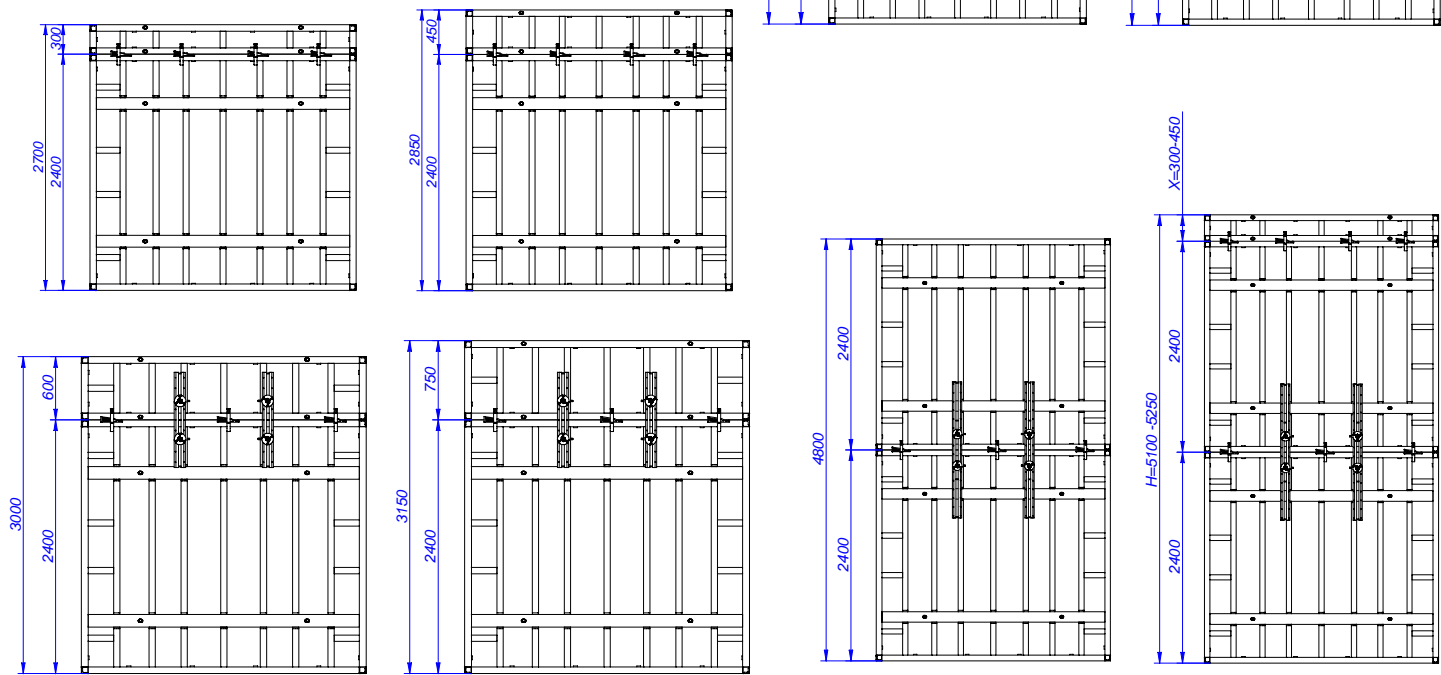
#### Range 3.3m and 1.2m

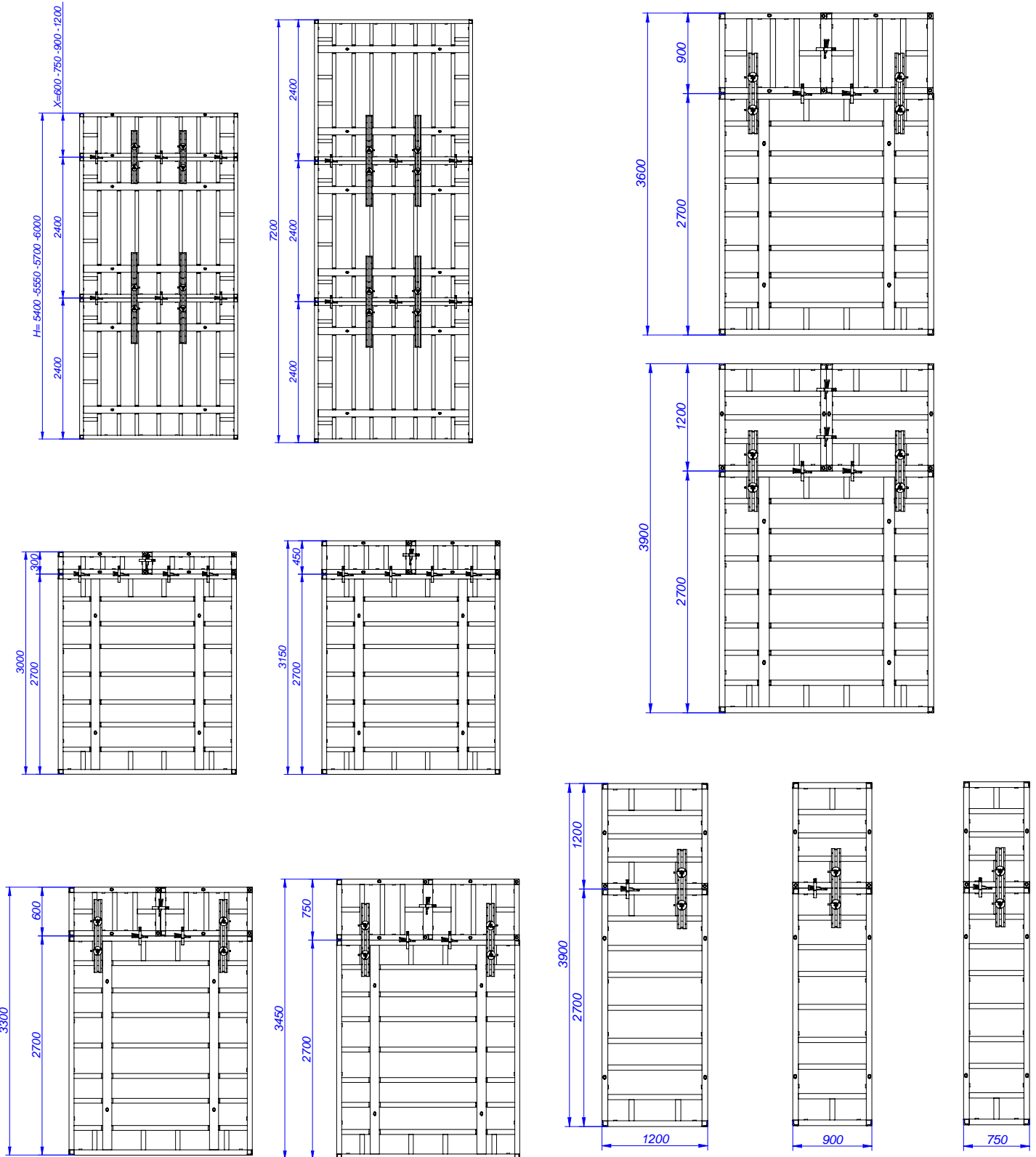


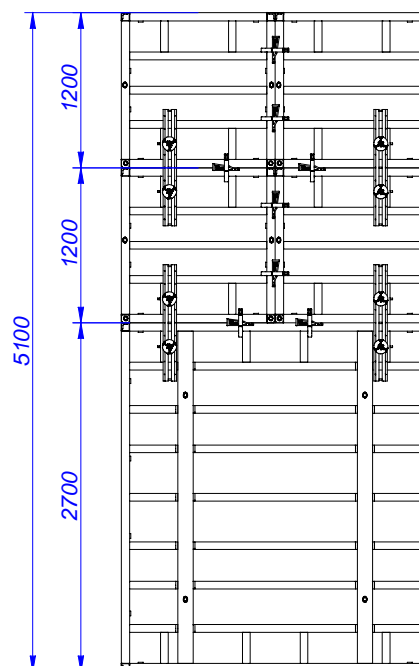
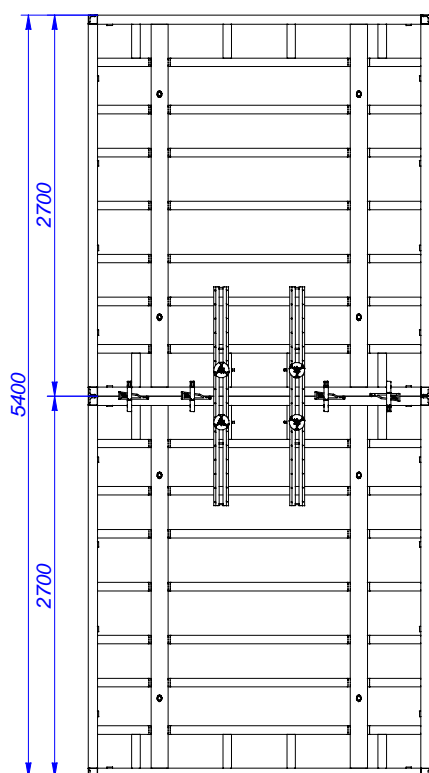
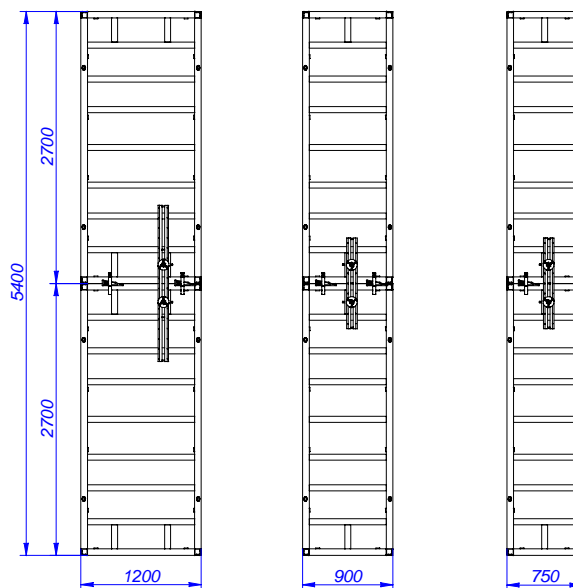
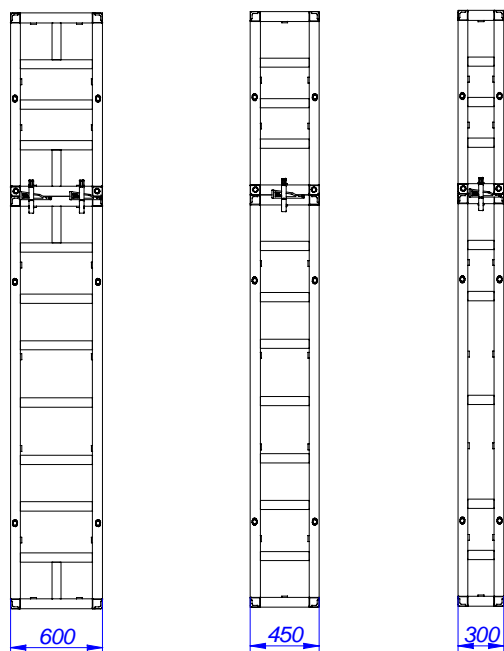




Range 2.7 and 1.2m







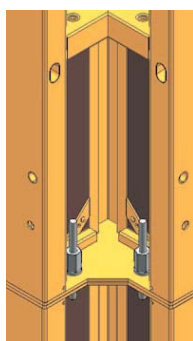
NOTE - For the configuration of Panel gangs higher than the ones shown in this document, consult with the Technical Department.



### 3.2. 90° CORNERS

INSIDE CORNER 2.7 is used on most internal sides of 90° CORNERS although it is also possible to place the HINGED INSIDE CORNER 2.7.

The vertical connection of the INSIDE CORNERS is always made with the SHORT THREADED ROD 0.35 and two HEXAGONAL NUTS 15 as it is shown in the following diagram.



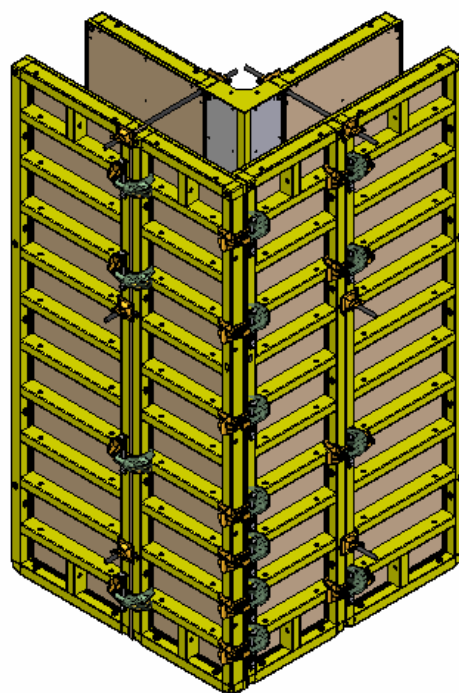
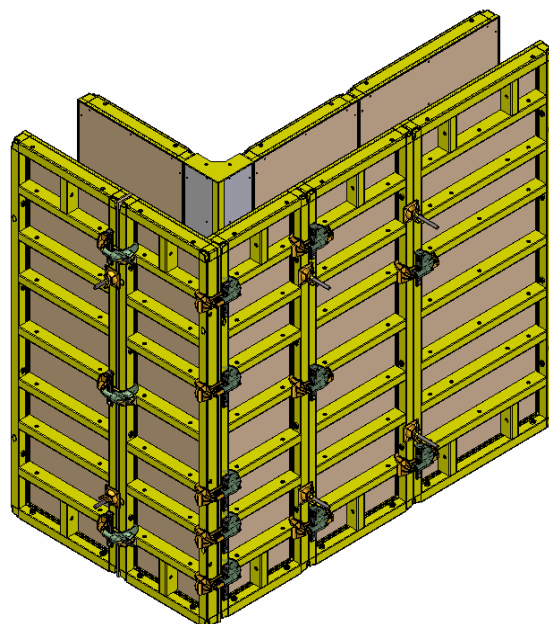
Vertical Corner connection

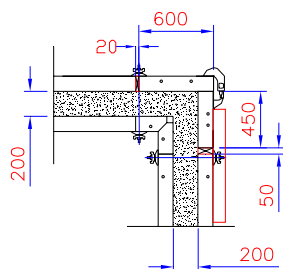
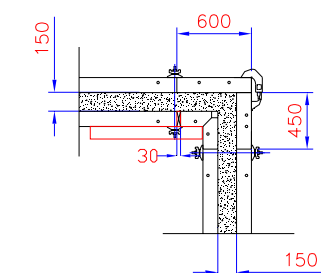
Different solutions for the external side of 90° corners:

#### 3.2.1 Panel in the edge

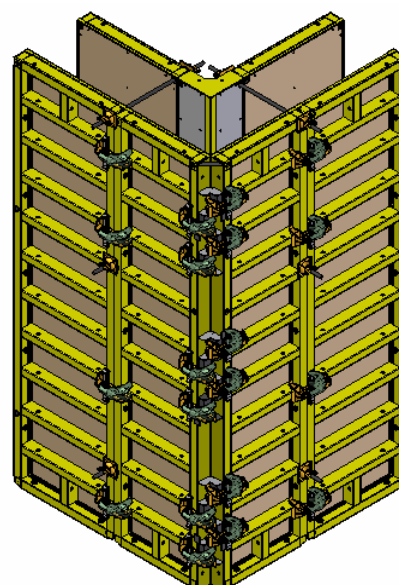
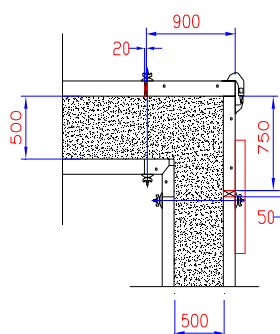
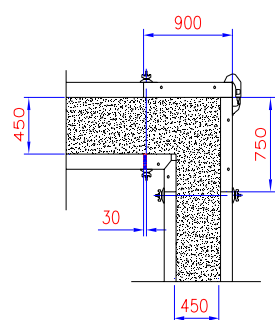
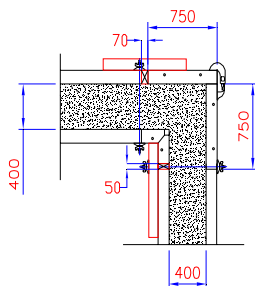
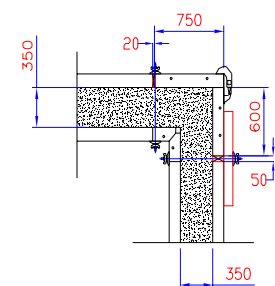
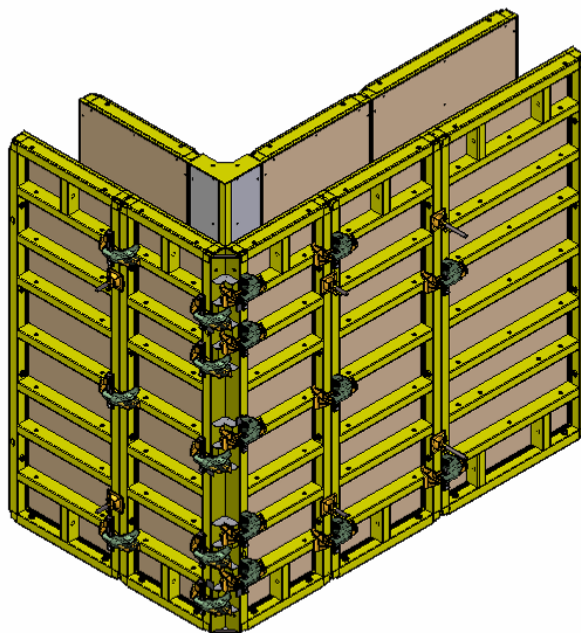
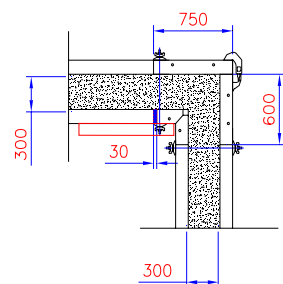
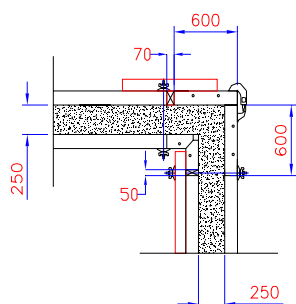
The 90° panel profiles are fixed using the ADJUSTABLE CLAMP.

- 7 clamps in 3.3m height
- 5 clamps in 2.7m height
- 3 clamps in 1.2m height.



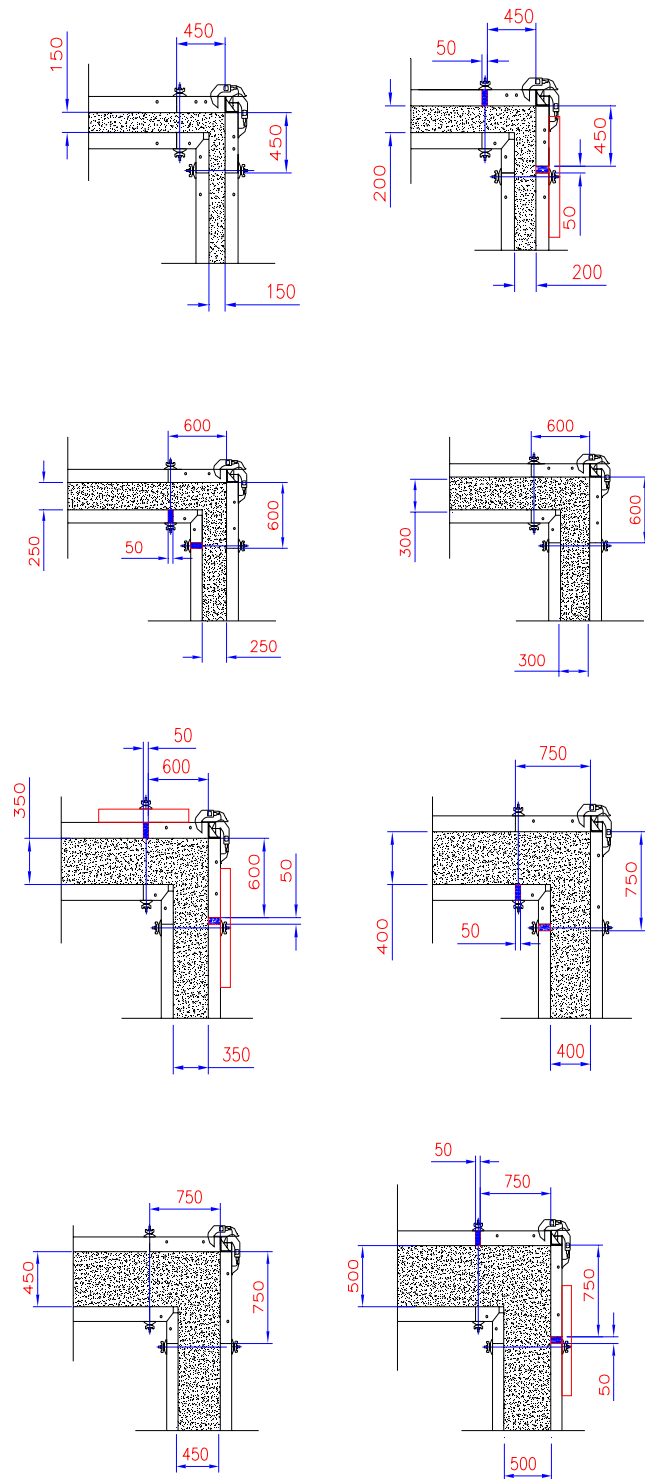


- 6 Clamps in 3.3m height.
- 5 Clamps in 2.7m height
- 2 Clamps in 1.2m height



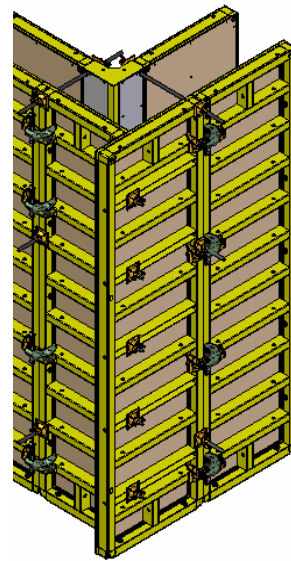
### 3.2.2 Outside corner

This component can be joined to the panels using two types of Clamps, the FIXED CLAMPS and ADJUSTABLE CLAMPS:

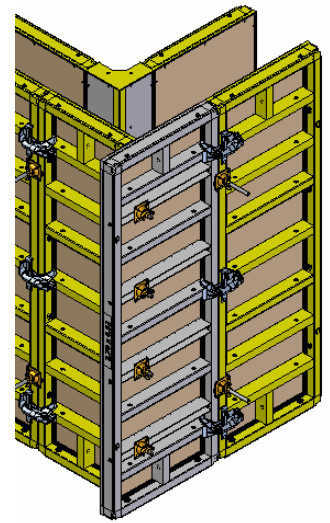


between UNIVERSAL PANEL and STANDARD panels. Using the different holes of the “U” shaped tubes of the UNIVERSAL PANELS facilitates a broad range of wall thicknesses.

For tying the panels, TIE BOLTS and PLATE WASHER NUTS are used.

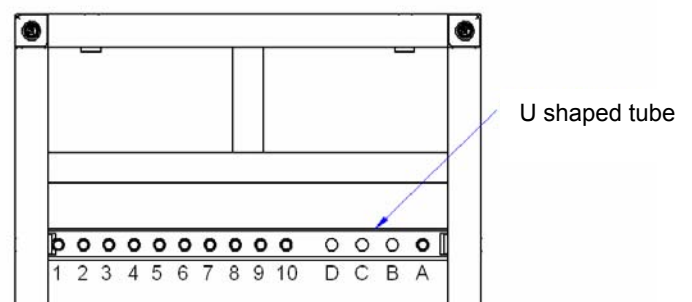


UNIVERSAL PANEL 3.3x0.92m



UNIVERSAL PANEL 2.7x0.92m

UNIVERSAL PANEL:



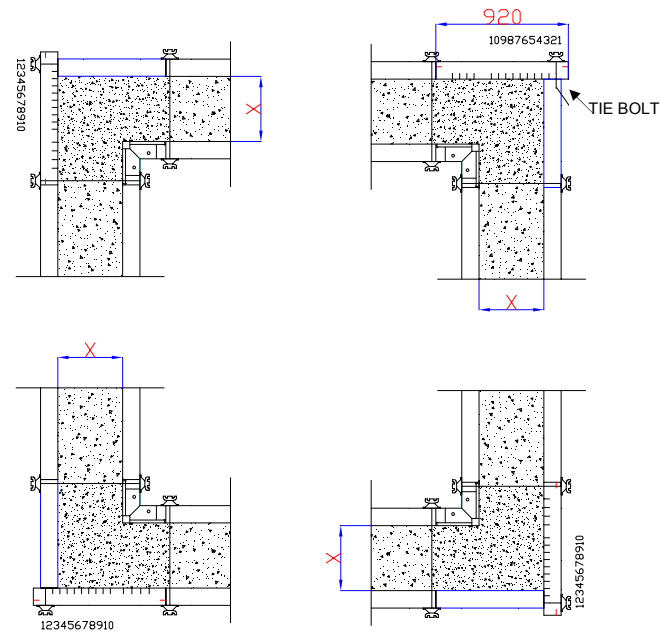
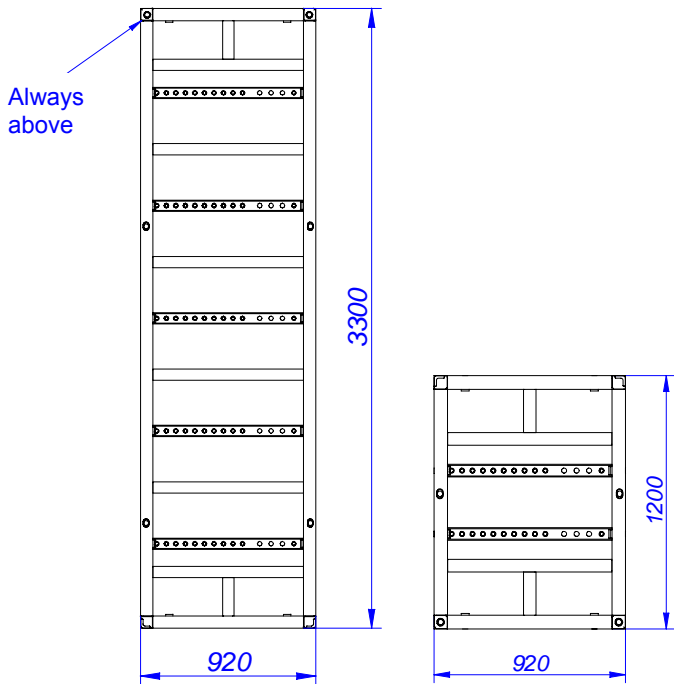
The letters A, B, C, D has a separation of 60 mm between them, whereas the numbers 1, 2, 3 ... have a separation of 50 mm between them.

### 3.2.3 Universal Panel:

In this case, one UNIVERSAL PANEL is used at least. Side of 90° corners can be solved by the combination

**RANGE 3.3m-1.2m**

Panels 3.3x0.92 and 1.2x0.92 are asymmetric, they must always place in the same vertical position and this makes them to occupy a determined situation in every corner solution. Look at the drawings below.

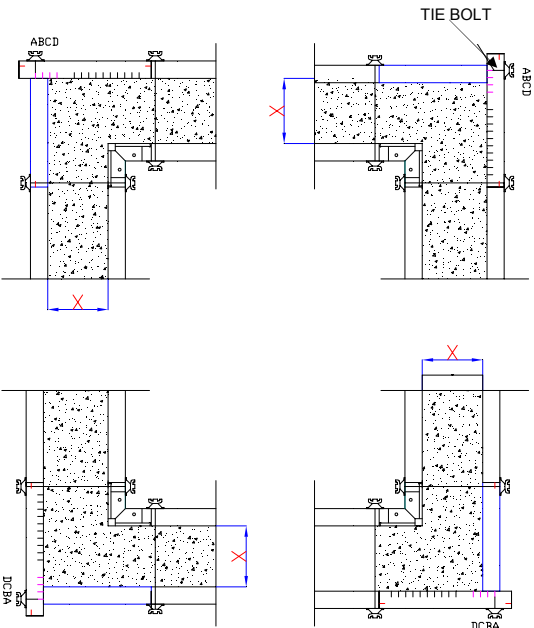


-Thicknesses of walls using holes letter:

	LETTER	X (mm)
UNIVERSAL PANEL 3.3x0.92 1.2x0.92	A	420
	B	360
	C	300
	D	240

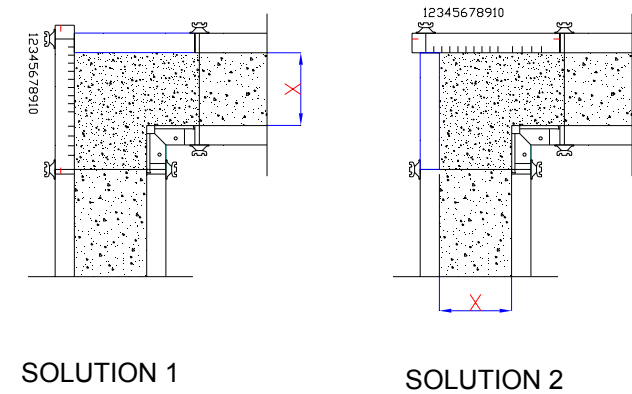
Thicknesses of walls using holes number:

	NUMBER	X (mm)
UNIVERSAL PANEL 3.3x0.92 1.2x0.92	1	450
	2	400
	3	350
	4	300
	5	250
	6	200
	7	150
	8	100
	9	50

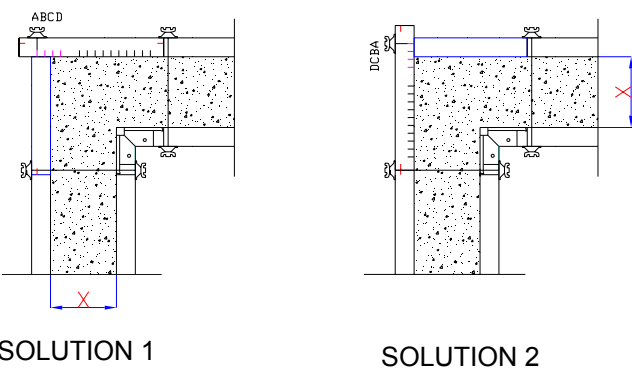


**Range 2.7m:**

These panels are symmetrical, therefore for the solutions of corner, can be placed like in the SOLUTION 1 or 2, (panel 3.3x0.92 and 1.2x0.92 are asymmetric, so only the solution 1 is valid).



	NUMBER	X (mm)
UNIVERSAL PANEL 2.7x0.92	1	450
	2	400
	3	350
	4	300
	5	250
	6	200
	7	150
	8	100



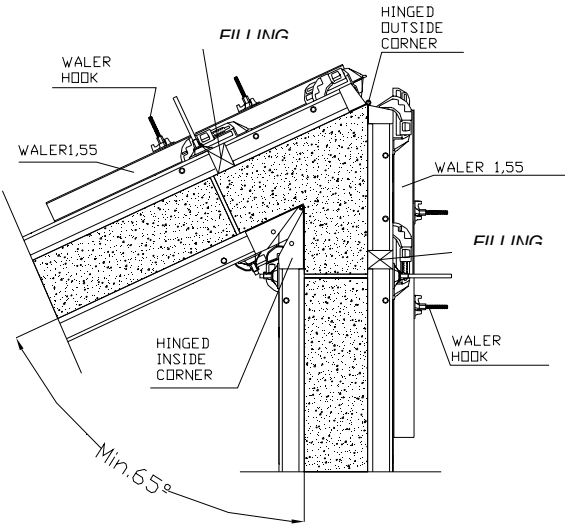
	LETTER	X (mm)
UNIVERSAL PANEL 2.7x0.92	A	420
	B	360
	C	300
	D	240

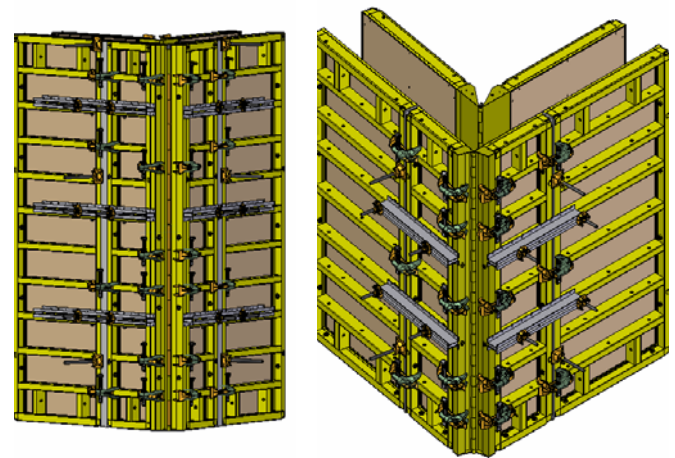
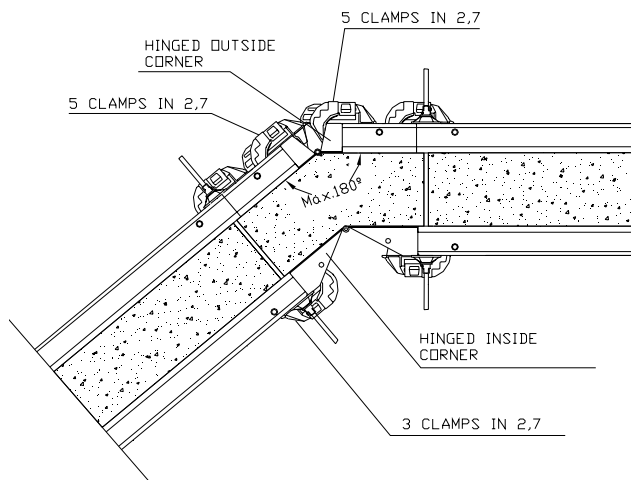
**3.3. HINGED CORNERS**

The solution for hinged corners is achieved by combining the HINGED INSIDE CORNER and HINGED OUTSIDE CORNER.

**3.3.1 65° - 180° CORNERS**

For these cases both types of corners are used in combination. The HINGED INSIDE CORNER is used on the inside angle and the HINGED OUTSIDE CORNER placed on the outside.





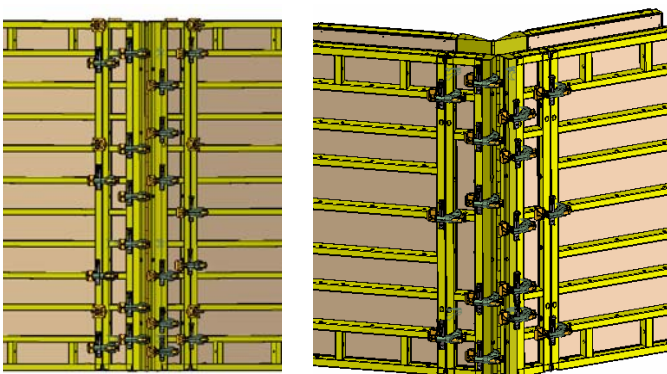
HINGED OUTSIDE CORNER 3.3. With filler      HINGED OUTSIDE CORNER 2.7. With filler

The following rules should be taken into account for these solutions:

- In the exterior side of corner, it should be used:
  - 6 Clamps for heights of 3.3m. Whenever there is significant filler between joints, they should be reinforced with 3 WALERS per side.
  - 5 Clamps for heights of 2.7m. Whenever there is significant filler between joints, they should be reinforced with 2 WALERS per side.
  - 3 Clamps for heights of 1.2m.

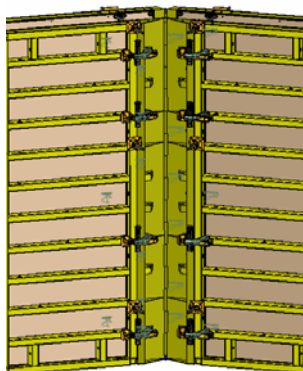
- Both clamps, FIXED and ADJUSTABLE, can be used on the external corner taking into account that for angles bigger than 130°, the ADJUSTABLE CLAMPS cannot be placed at the same level on both sides. They should be placed in different levels to avoid collision between them
- The FIXED CLAMP is used for inside corners between 65°-75°. Both Clamps can be used for larger angles. In both cases it is recommended to place them on different levels.
- For the inside corner, place 3 Clamps for heights of 2.7m and 2 Clamps for 1.2m (each side).

Likewise, whenever there are significant fillers between panels they should be reinforced with: 3 WALERS and 4 CLAMPS on each side for a height of 3.3m. and 2 WALERS and 3 CLAMPS on each side for a height of 2.7m.

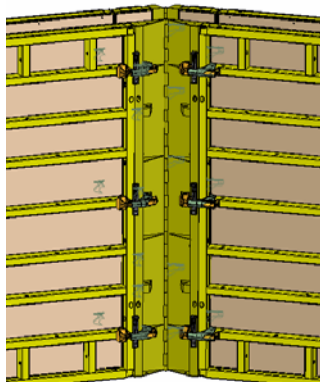


HINGED OUTSIDE CORNER 2.7. Without filler

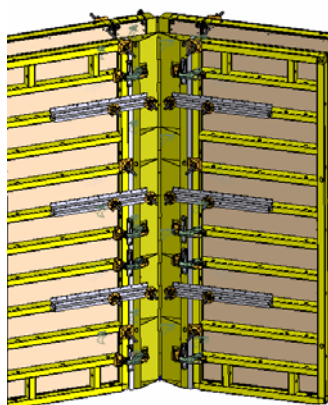
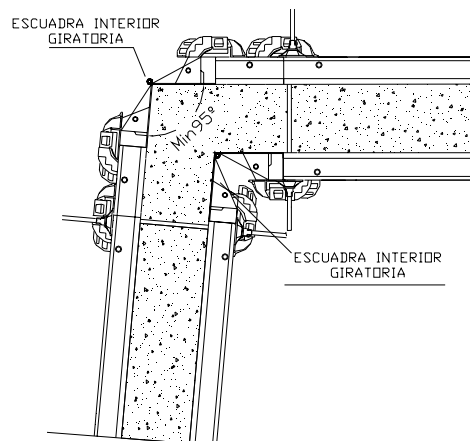




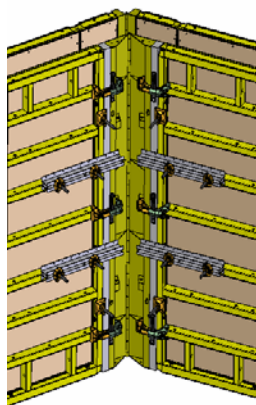
HINGED OUTSIDE CORNER 3.3.  
Without filler



HINGED OUTSIDE CORNER 2.7. Without filler



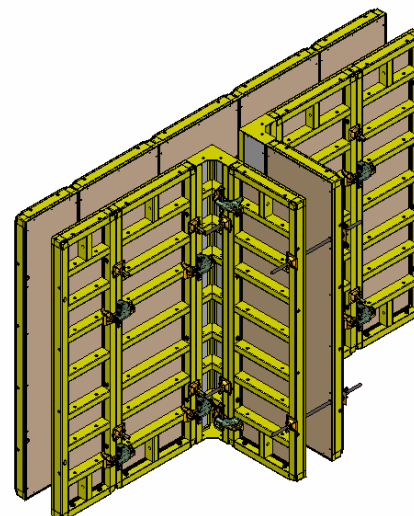
HINGED OUTSIDE CORNER 3.3.  
With filler



HINGED OUTSIDE CORNER 2.7.  
With filler

### 3.4. 90° WALL INTERSECTIONS

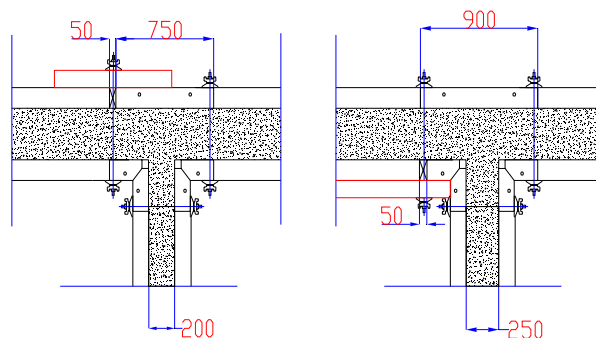
The FIXED CORNER is used with the different panel widths to solve different wall thicknesses.

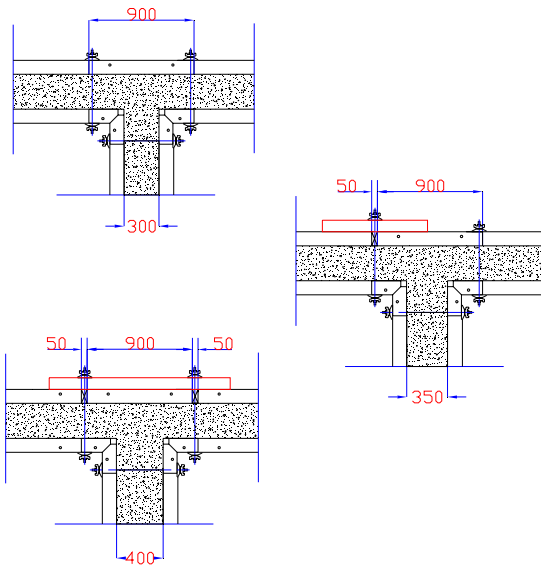


#### 3.3.2 95° - 180° CORNER

For this range it is possible to use the HINGED INSIDE CORNERS on both wall faces as shown in the following diagram.

WALERS should still be used when there are wooden fillers in the joint, and CLAMPS alone can be used if there are no fillers.





### 3.5. BULKHEADS

Bulkhead solutions can be provided in many different ways:

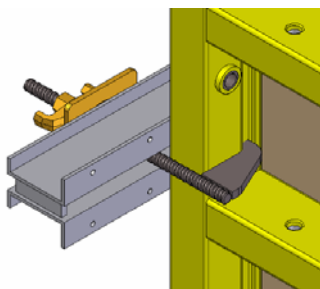
#### 3.5.1 With walers

Bulkhead solutions using WALERS depends on the fixing element utilized.

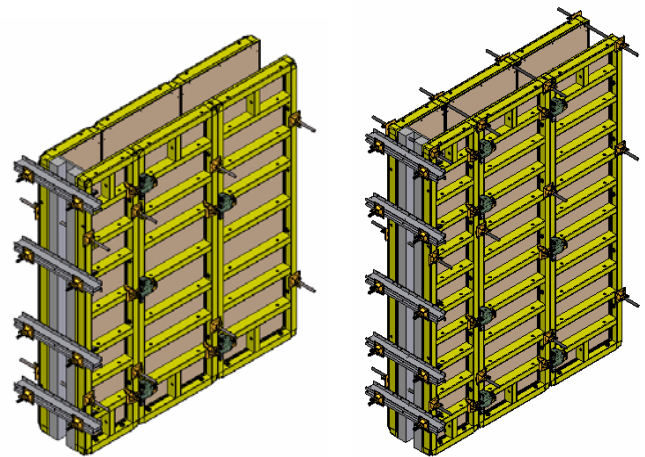
##### 3.5.1.1 *With bulkhead hook*

The WALERS are fastened to the panels with the BULKHEAD HOOK placed on the frame profile and the PLATE WASHER NUT 15.

TIE RODS are necessary in the panel adjacent to the bulkhead.



PANEL TYPE	NUMBER OF WALERS
PANEL HEIGHT 3.3	5
PANEL HEIGHT 2.7	4
PANEL HEIGHT 2.4	3
PANEL HEIGHT 1.2	2



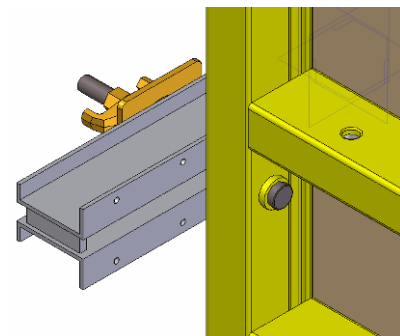
Bulkheads with walers 2.7m

Bulkheads with walers 3.3m

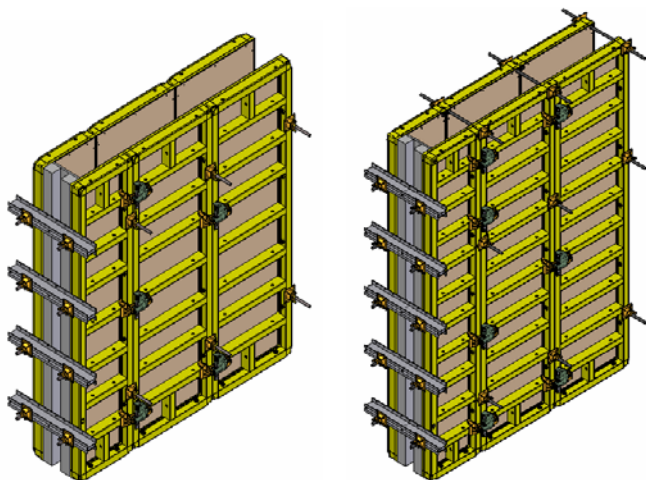
##### 3.5.1.2 *With Tie bolt*

The WALERS are fastened to the panels by inserting the TIE BOLT through the panels' lateral holes securing them with PLATE WASHER NUT 15.

If 0.3m wide PANELS are used, they are tied with the BULKHEAD BOLT and BULKHEAD NUT 15, due to lack of space in the assembly.





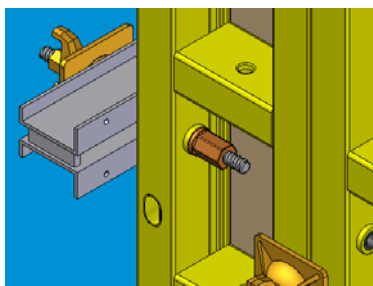
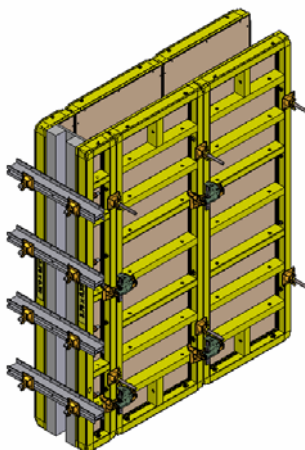


Bulkhead with 4 tie rods in height 2,7m

Bulkhead with 5 tie rods in height 3,3m

### 3.5.1.3 With **SHORT PIN** and **HEXAG. NUT 15**

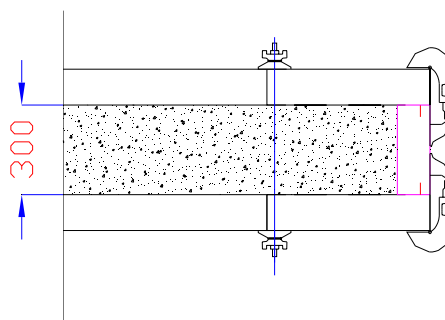
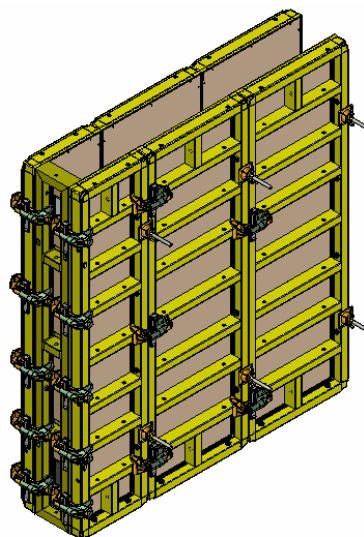
This type of bulkhead with **SHORT PIN** and **HEXAGONAL NUT 15** is used when the wall is finished or closed with panels of width 0.3m.



### 3.5.2 With panel in the edge

In these cases the panel width must coincide with the thickness of the wall, placing the panels in the corner and tying them with the **ADJUSTABLE CLAMP**.

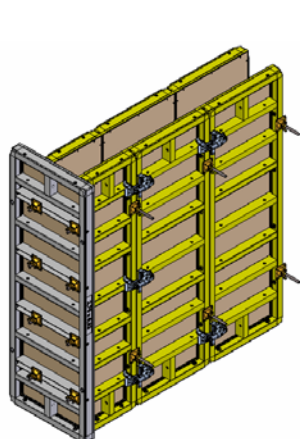
- 7 clamps in 3.3m height
- 5 clamps in 2.7 m height
- 3 clamps in 1.2 m height



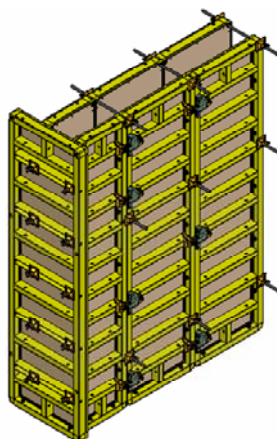
NOTE: This solution is limited to wall thickness of 45cm.

### 3.5.3 With UNIVERSAL PANEL

The UNIVERSAL PANEL is tied to the standard panels with the TIE BOLTS and the PLATE WASHER NUT 15

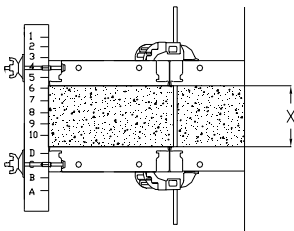


Bulkhead with  
universal 2,7x0,92m



Bulkhead with  
universal 3,3x0,92m

The thicknesses of wall can change between 7 and 55cm. These are all the possible combinations:

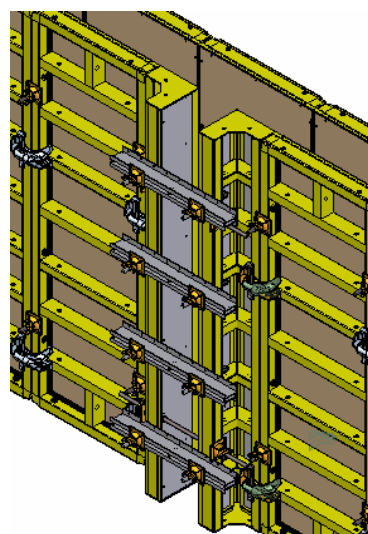
	THICKNESSES OF WALL				
	A	B	C	D	
 <p>UNIVERSAL PANEL</p> <p>0.92</p>	1	550	490	430	370
	2	500	440	380	320
	3	450	390	330	270
	4	400	340	280	220
	5	350	290	230	170
	6	300	240	180	120
	7	250	190	130	70
	8	200	140	80	
	9	150	90		
	10	100			

## 3.6. *PILASTERS*

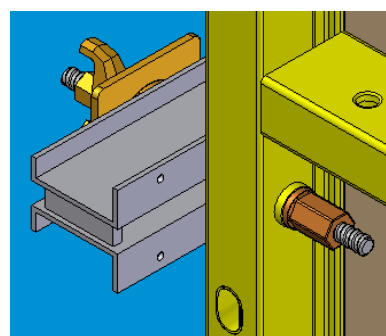
Pilaster solutions:

### 3.6.1 With walers

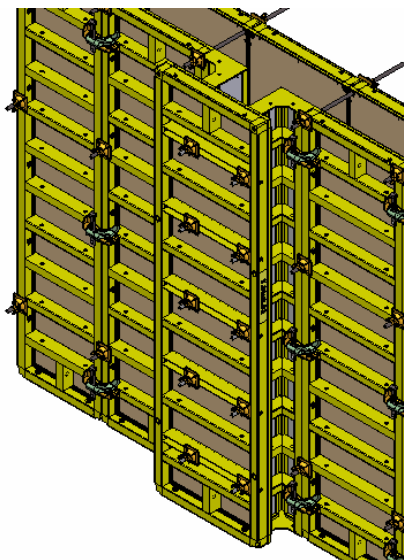
For this kind of solution, SHORT PIN and HEXAGONAL NUT 15 are used.



Pilaster with inside corner 2.7

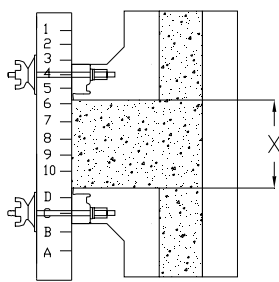


### 3.6.2 Inside corner with Universal panel



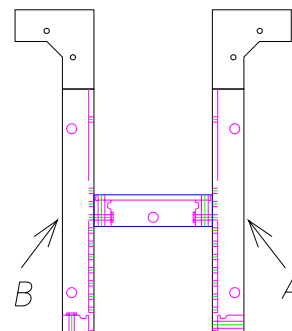
Inside corner with Universal panel 3.3x0.92

For this solution, SHORT PIN and HEXAGONAL NUT 15 are used.

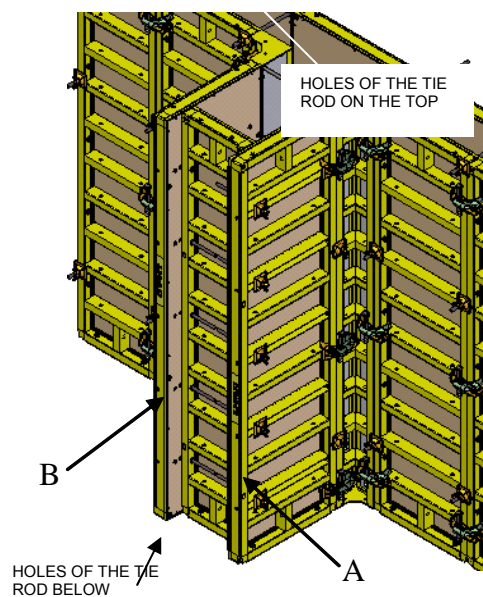
		thicknesses of wall				
			A	B	C	D
 <p>UNIV. PANEL 0.92</p>	1	550	490	430	370	
	2	500	440	380	320	
	3	450	390	330	270	
	4	400	340	280	220	
	5	350	290	230	170	
	6	300	240	180	120	
	7	250	190	130	70	
	8	200	140	80		
	9	150	90			
	10	100				

### 3.6.3 Universal panel with standart panel

For this solution, UNIVERSAL PANELS are placed face to face and the holes of the U shaped tube have to coincide.



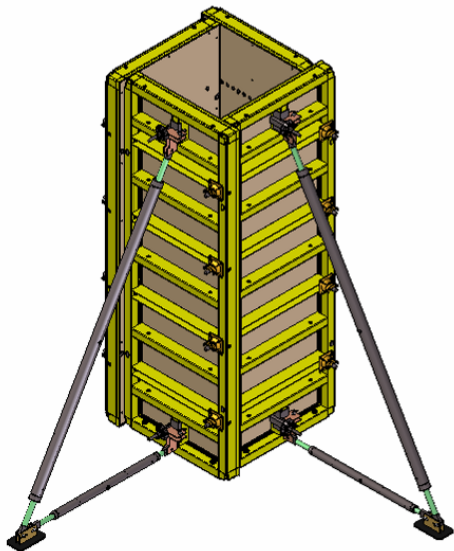
The UNIVERSAL PANELS 3.3x0.92 and 1.2x0.92 are asymmetric, so one of the panels has the holes of the TIE RODS on the top (A), whereas the other panel has them below (B).



For this solution the holes of the TIE RODS are not used, so it is possible to place the UNIVERSAL PANELS 3.3x0.92 and 1.2x0.92 in the position of the picture above. The TIE RODS pass from the holes of the INSIDE CORNER.

The universal panels 2.7x0.92, is symmetrical.

3.7. COLUMN FORMING



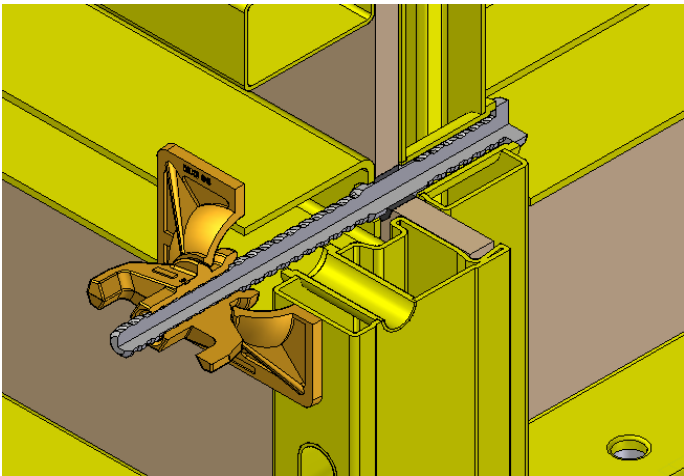
through which the TIE BOLTS are inserted. Depending on hole used, the panel dimensions will change.

	HOLE NUMBER	COLUMN (mm)	LETTER	COLUMN (mm)
UNIVERSAL PANEL 3.3x0.92	1	750	A	720
	2	700	B	660
	3	650	C	600
	4	600	D	540
	5	550		
	6	500		
	7	450		
	8	400		
	9	350		
	10	300		

UNIVERSAL PANEL 0,92

3.7.1 Tie bolt

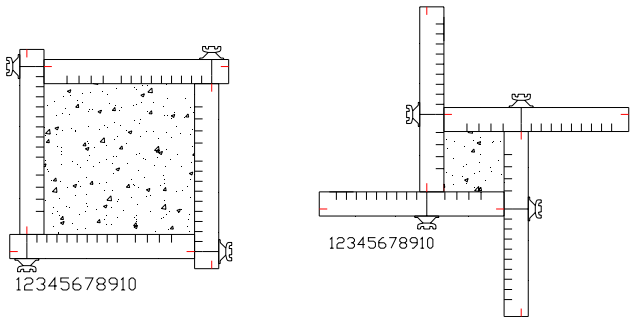
The panels are fastened by the TIE BOLT and PLATE WASHER NUT 15.



**Universal panel 3.3x0.92:**

The UNIVERSAL PANEL 3.3x0.92 has several “U” shaped multipunched ribs with holes every 50mm

MAX. COLUMN= 750mm      MIN. COLUMN= 300mm

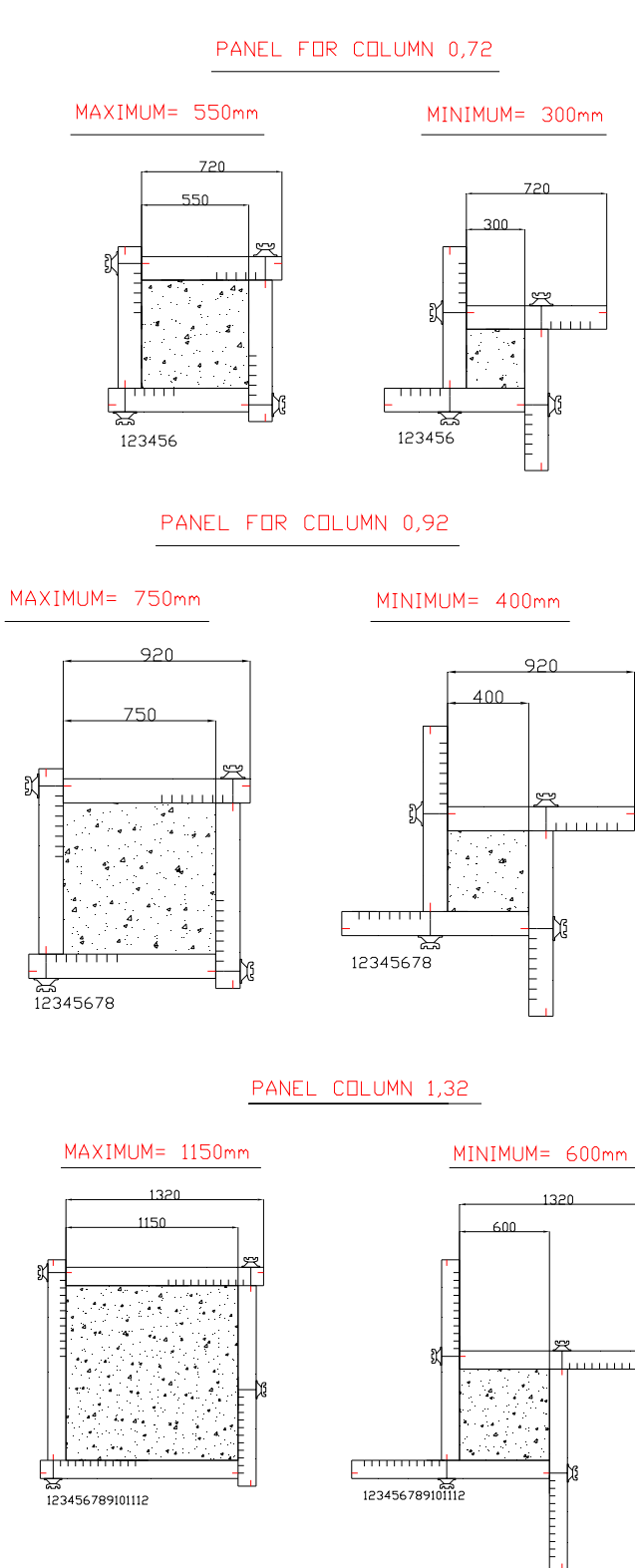


**Panel column 2.7m, 1.2m y 0.6m:**

There are different PANEL COLUMNS according to their width: 0.72m-0.92m-1.32m, all available in heights of 2.7m, 1.2m and 0.6m.

The panels have several “U” shaped multipunched ribs with holes every 50mm through which the TIE BOLTS are inserted. Depending on hole used, the panel dimensions will change.

The following pictures show the maximum and minimum columns dimensions for each model.



Each PANEL-COLUMN has a range of three heights: 2.70m, 1.20m and 0.60m. Each of them has a different number of multiphubbed ribs.

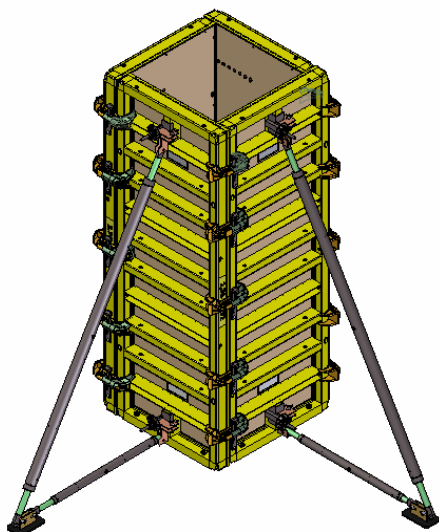
PANEL TYPE	NUMBER OF multiphubbed ribs
PANEL-COLUMN 2.7m	4
PANEL-COLUMN 1.2m	2
PANEL-COLUMN 0.6m	1

### 3.7.2 Panel in the edge

This solution allows solving columns up to 1200x1200, but always taking into account that the column height is not higher than 3.3 m.

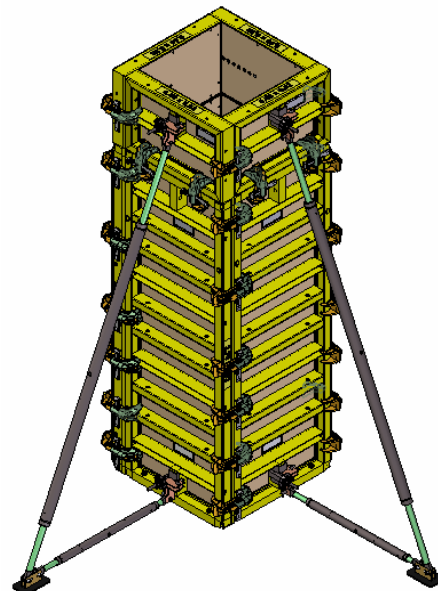
PANEL	NUMBER OF CLAMPS IN HEIGHT
HEIGHT 3.3m	7
HEIGHT 2.7m	5
HEIGHT 1.2m	3
HEIGHT 0.6m	2

#### Panel 2.7m:



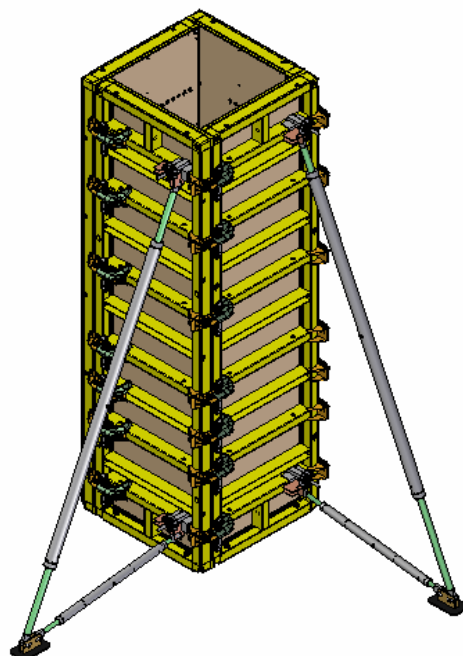
Column 2.7m: 5 clamps in height

#### Panel 2.7+0.6m:



Column 3.3m with panels 2.7m+0.6m: 7 clamps in height

#### Panels 3.3x0.92m:



Column 3.3m: 7 clamps in height



### 3.8. FILLER BETWEEN PANELS

Often it is necessary to insert wood filler or compensation elements between panels in order to achieve the required wall dimensions. Depending on the filler size to be inserted, different solutions can be used.

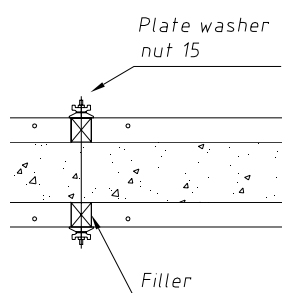
**The limit of opening of the ADJUSTABLE CLAMP is 10 cm**

#### 3.8.1 Job built filler 0<X<10 cm

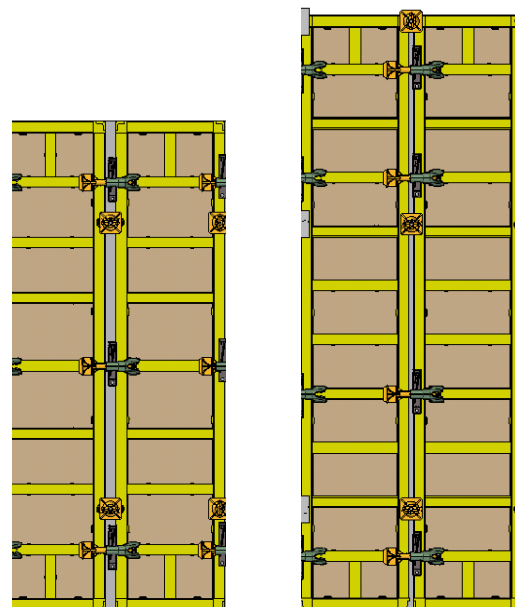
For any wooden filler smaller than 10cm, the following solutions are possible:

##### 3.8.1.1 Tie rod through the filler + Plate washer nut 15

The TIE RODS will be inserted through the wooden filler and the PLATE NUT D15 is placed as support element on the ORMA panels. They are fastened using the ADJUSTABLE CLAMPS.



Max. filler between panels: **10cm**

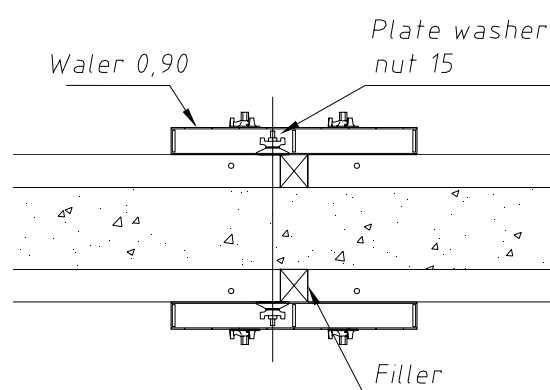


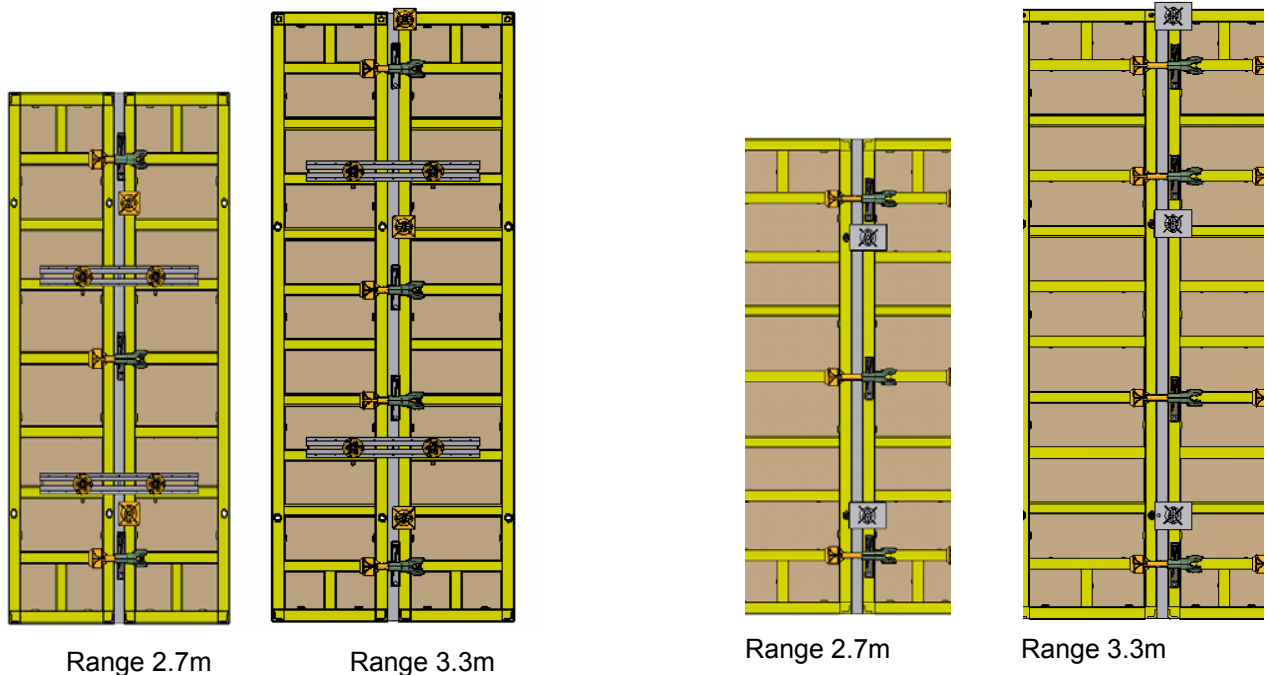
Range 2.7m

Range 3.3m

##### 3.8.1.2 Tie rod through the panel + Waler

The TIE RODS will be placed through the panel holes and using the WALER 0.90 as support element on its ribs. The fastening between panels is done with the ADJUSTABLE CLAMPS.

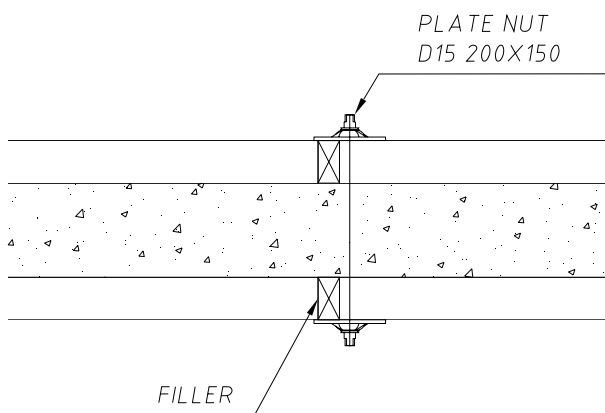




### 3.8.2 Job built filler 10-30 cm

#### 3.8.1.3 Plate nut D15 200X150 (filler <7 cm)

The TIE RODS will be placed through the panel holes and the PLATE NUT D15 200X150 is placed as support element on the ORMA panels. They are fastened using the ADJUSTABLE CLAMPS. The fillers must be smaller than 7 cm.

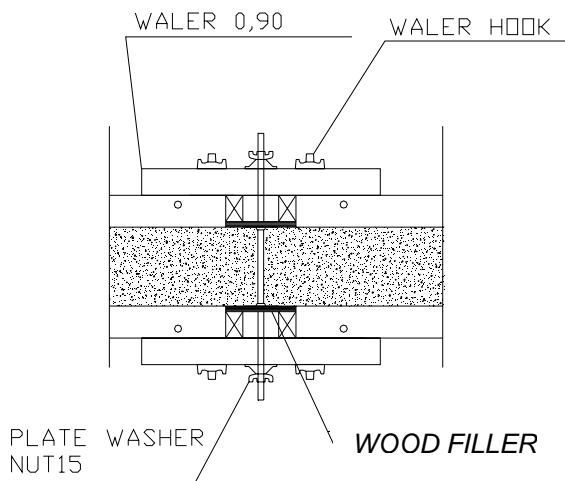


#### 3.8.2.1 Wooden filler

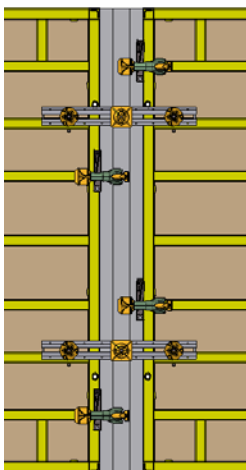
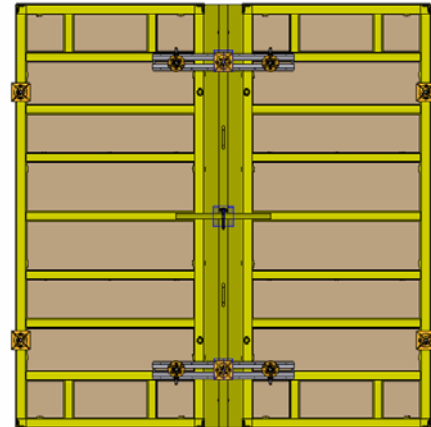
Any filler 10-30cm requirements can be solved using wooden filler adapted to the required dimensions.

A "wooden panel" can be made with 21mm thick plywood, cut to the required dimensions and reinforced laterally with WOODEN PROFILE. These wooden reinforcements are joined to the panels with ADJUSTABLE CLAMPS; the TIE RODS can pass right through the middle of the filler and through the WALER.

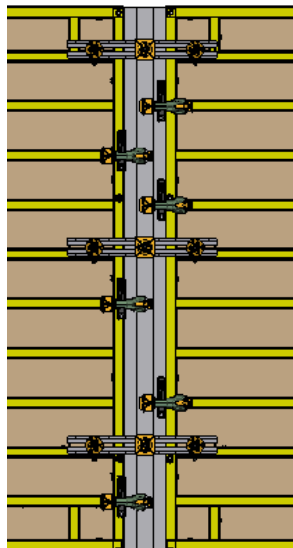




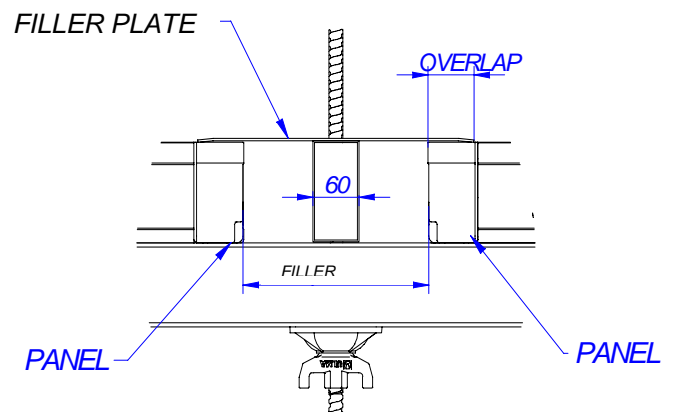
In this case the TIE RODS will be inserted through the COMPENSATION PLATES holes, fixing them on the WALERS 0.90 that will be fastened to the panels with the WALER HOOKS.



Range 2,7m

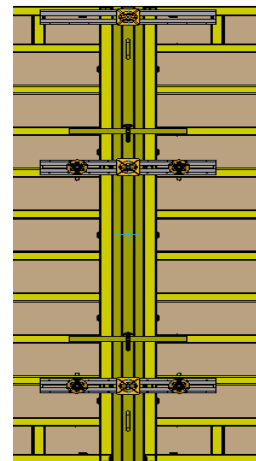


Range 3,3m



### 3.8.2.2 COMPENSATION PLATE

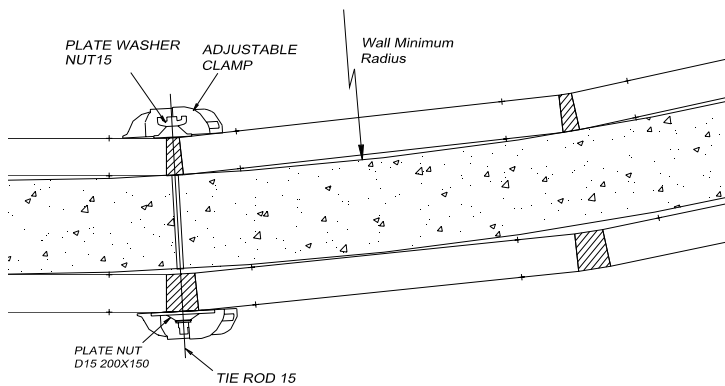
Fillers between 6 and 30cm can be solved by placing the COMPENSATION PLATES in both sides of the wall; they are always used with the panels in vertical position. The proper filler dimension is achieved by cutting back the panels on both sides as much as necessary over the form plate. Thus, the minimum filler measurement is given by the center tube of the COMPENSATION PLATE when the panels are flush against it.



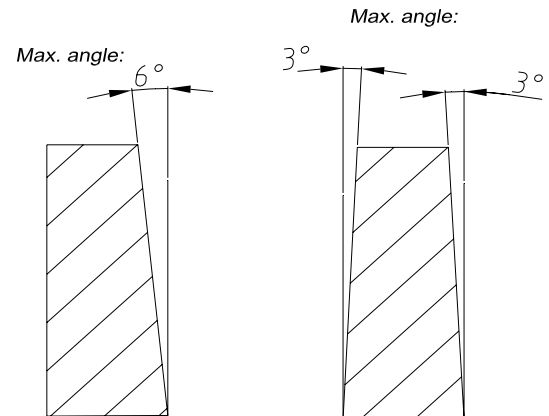
### 3.9. POLYGONAL WALLS

Polygonal walls of the following minimum radius can be made with the ORMA panels.

PANEL WIDTH (m)	WALL MINIMUM RADIUS (m)
2.7	25.8
2.4	22.9
1.2	11.45
0.9	8.6
0.75	7.15
0.6	5.73
0.45	4.3
0.3	2.85

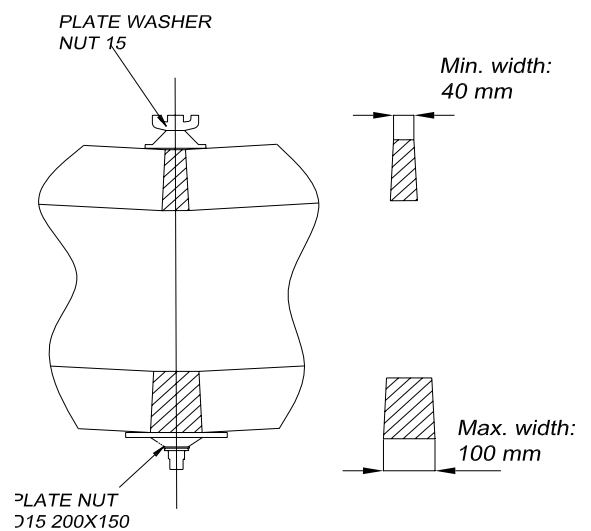


These values are obtained taking into account that the maximum angle the ADJUSTABLE CLAMP can fasten between panels is 6°.



It is necessary to place wooden filler between panels for this type of walls. It is recommended that the TIE RODS be passed through the wooden filler in order to fix both panels after placing the PLATE WASHER NUT 15.

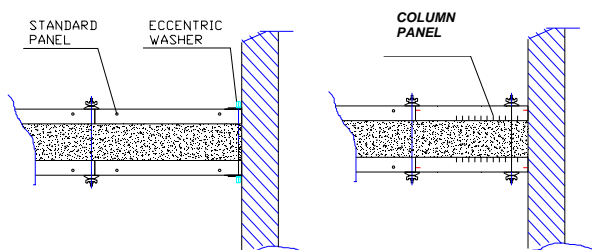
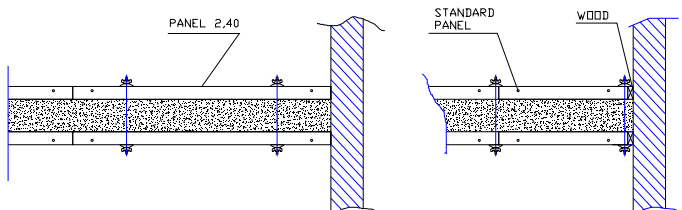
If the wooden filler width is over 50 mm, the PLATE NUT D15 250x150 should be used.



### 3.10. JOINING WALL FORMING STAGES

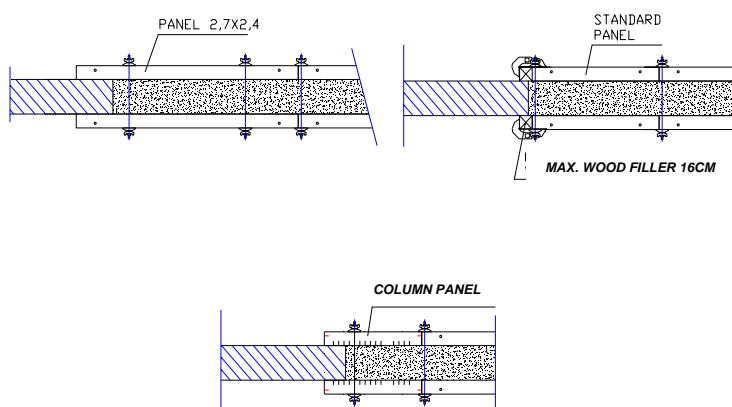
Different solutions for different wall cases are shown below:

### 3.10.1 Close to transversal wall



### 3.10.2 Close to longitudinal wall

Different solutions are shown below:



In these cases the general assembly is the same as the one used for straight walls, but it is necessary to take into account some considerations due to the inclination.

All the values presented in this section are referred for using panels with TIE RODS 15 and using them in their 2.7m and 3.3m high vertical position.

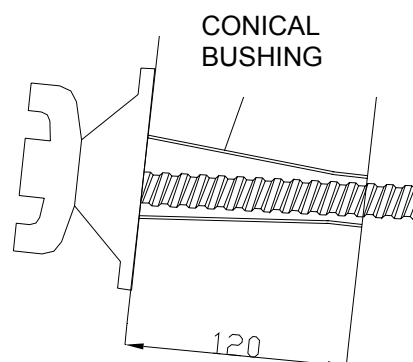
For these inclined walls, when pouring, there are vertical forces on formwork panels, which can lift the panels. Thus, before pouring it is necessary to adequately anchor the formwork panels to the ground to resist such forces.

### 3.11.1 Inclination up to 10% ( 6°)

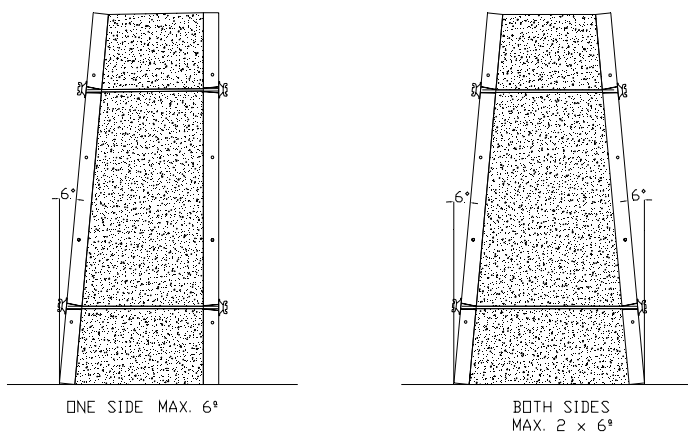
#### Range 2.7m:

In these conditions, the ORMA standard panels allow us to reach a 10% inclination; this is approximately a 6° incline with respect to the vertical axis.

This limit of 6° is due to the angle of the conical bushing placed inside the panel's holes to facilitate inserting the TIE RODS.

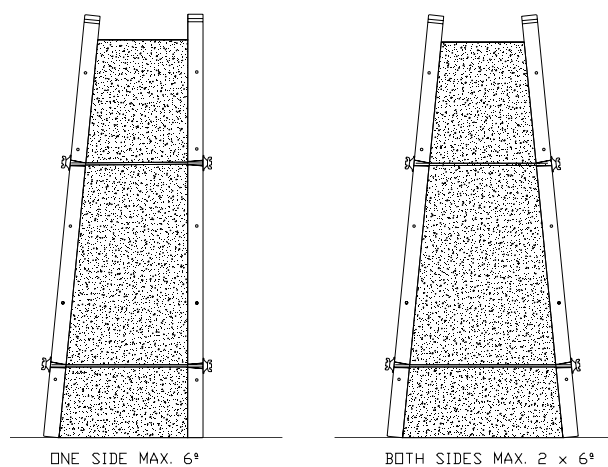


## 3.11. **INCLINED WALLS**

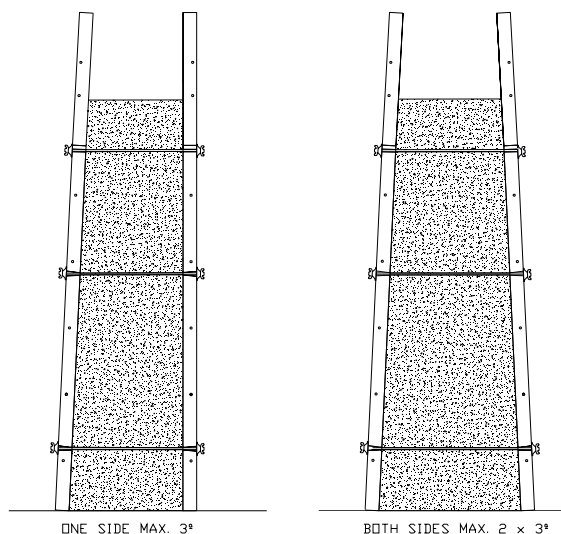


### Range 3.3m

For walls which height is equal or less than 3.30m and just 2 TIE RODS in height are used, the limitation of the angle is 6°:



For walls which height is bigger than 3.3m, the limitation of the angle is 3°. The inclination suffers an important limitation because the top hole is used and it is not conical.



The PLATE WASHER NUT 15 in no case is an impediment or problem for this type of solutions.

### 3.11.2 Inclination > 10%

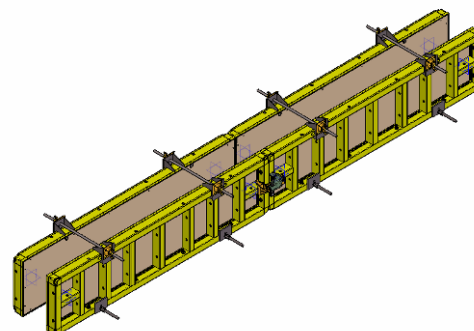
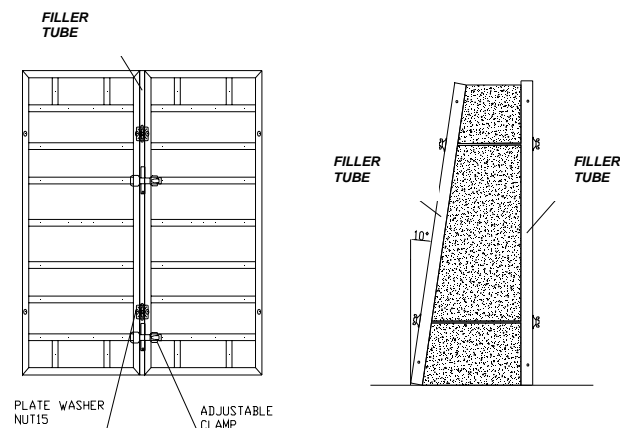
The COMPENSATION TUBES should be used for walls where the inclination is greater than 10% (6°).

The COMPENSATION TUBES are placed on the joint of two consecutive panels fastening them with ADJUSTABLE CLAMPS.

The TIE RODS 15 should be inserted through the COMPENSATION TUBES instead of passing through the panels.

The COMPENSATION TUBES must be placed on both sides, even if the wall is not inclined on one of the sides.

The use of PANEL 3.3X2.4 and 2.7X2.4 is not allowed for this solution because the four TIE RODS would be replaced in that case with only the two ties that are inserted through the tubes at the joint. Thus, they would be overload.



### 3.12. FOUNDATIONS

Different situations encountered when placing formwork for foundations are presented below:

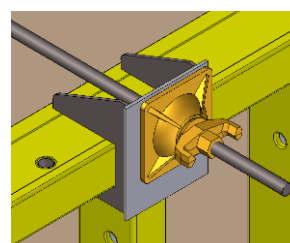
#### 3.12.1 Open air foundations

When laying open air footers it is very common to use horizontally placed panels, using TIE RODS as shown in the following cases.

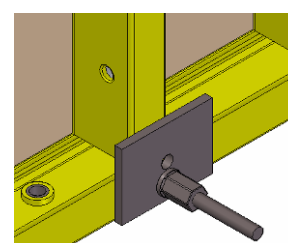
##### 3.12.1.1 *Panel placed on the ground*

With panels in direct contact with the ground, it is necessary to fix the panel using the lower TIE RODS and HEXAGONAL NUT15 which always should be used with ECCENTRIC WASHER to avoid churning into the panel profile.

Upper TIE RODS are fixed by placing the TOP TIE BRACKET 65 over the profile, thus permitting the rod to pass above the concrete level.



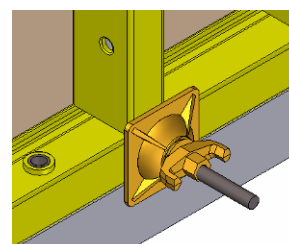
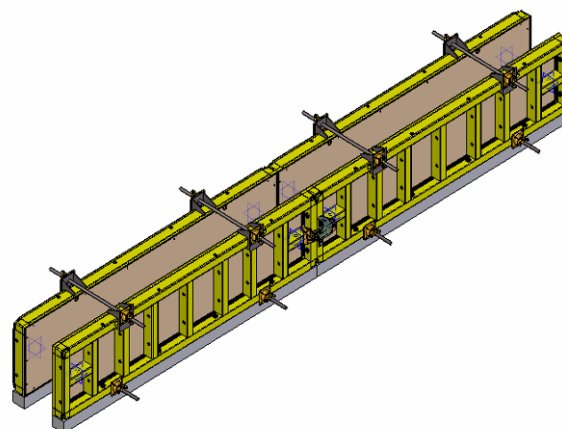
TOP TIE BRACKET 65



HEXAGONAL NUT 15 +  
ECCENTRIC WASHER

##### 3.12.1.2 *Panel placed on wood sills*

In this case, it is possible to use PLATE WASHER NUT15 to fasten the lower TIE RODS supported over the profile and the wood.

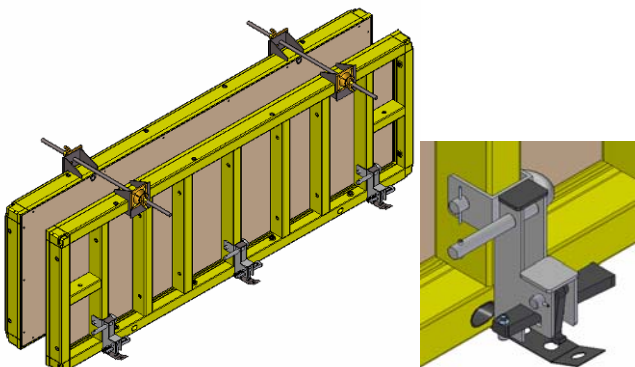


WOOD SILL + PLATE WASHER NUT 15

### 3.12.2 Foundations in trenches

When forming foundations in trenches, the formwork is propped against the trench walls using wooden braces. TIE RODS are not used.

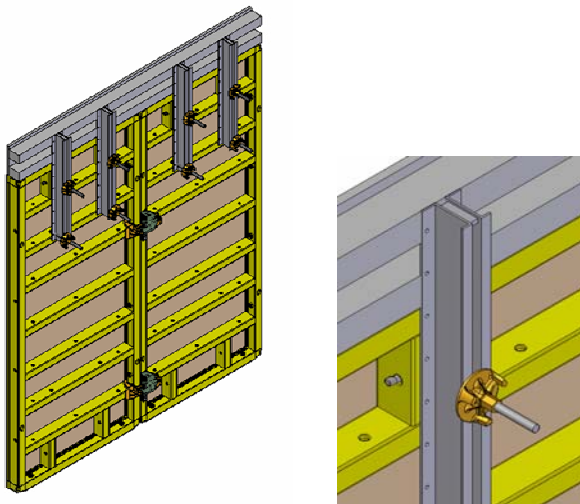
In these cases it is also possible to place the FOUNDATION HEAD and FOUNDATION PLATE on the lower part of the panels to support the concrete pressure exerted on the base of the formwork.



### 3.13. UPPER EXTRAFORMWORK

WALERS 0.90, fixed to the upper part of the panels, are used as a base support, and they facilitate certain wooden formwork extensions.

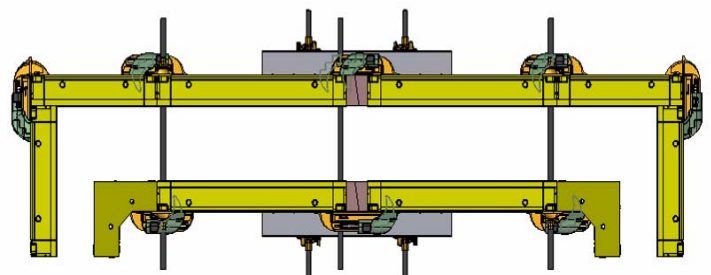
These formwork extensions can provide up to 25 cm of extra formwork on the top side of a wall.



### 3.14. STRIPPING AT CORNERS IN HOLLOWS

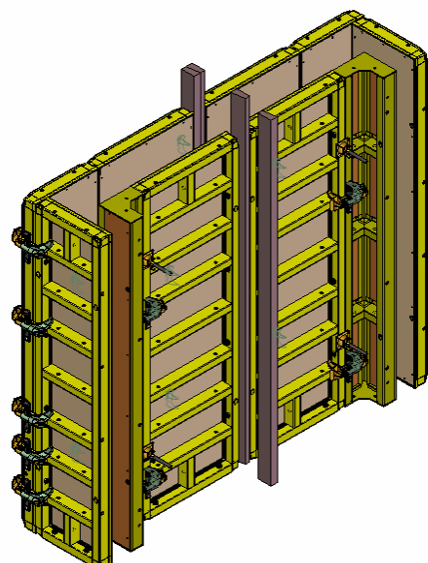
To simplify stripping the panels between fixed corners, for example building containers or **elevator** shafts, it is necessary to place wood filler on those faces. Stripping should begin at this point.

Two WOODEN BEVELED EDGE joined face to face forming 100mm filler are used in this case.



It is good to grease the WOODEN BEVELED EDGES beforehand, so that later they can be extracted easily.

The length of these elements is 3m to assure they extend above the formwork (h=2.7). The stripping process begins by striking those elements in the upper area.



### 3.15. WATER STOP SOLUTION

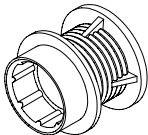
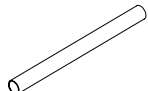
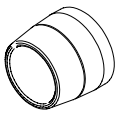
There are two basic systems to provide water stop solutions for deposits, tanks...

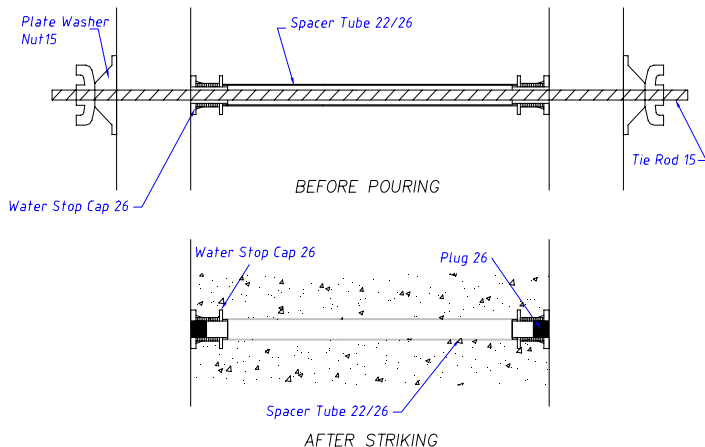
#### 3.15.1 Water stop system 26

This system will withstand a hydrostatic pressure equal to 10m head of water.

It is installed at each end of the SPACER TUBE (as shown in the picture).

In structures where hydrostatic pressure is only exerted on one face of the wall, the WATER STOP CAP 26 can be installed just on that side and CONE 22 can be used on the other.

CODE	NAME	
7238049	Water stop cap 26	
7238047	Spacer tube 22/26	
7238050	Plug 26	

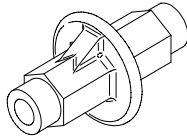
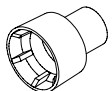
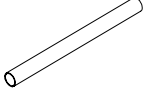


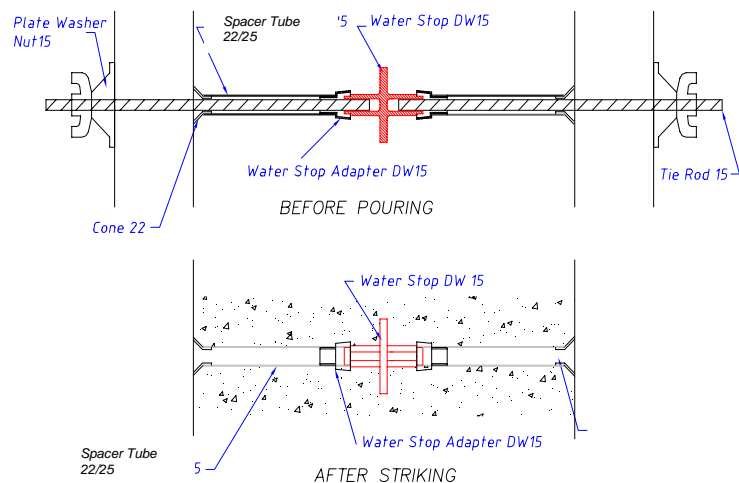
#### 3.15.2 Water stop system DW15

This system will withstand a hydrostatic pressure equal to 70m head of water.

The WATER STOP DW15 is installed in the middle of the wall together with the WATER STOP ADAPTER DW15, which is used to connect, the TIE ROD on both sides along with standard spacer parts.

All These components, except the tie rod, will remain in the concrete.

CODE	NAME	
0230004	Water stop DW15	
9371966	Water stop adapter DW15	
7230455	Spacer tube 22/25	





### 3.16. CLIMBING

The CLIMBING BRACKET is the base component used as support for the formwork when is necessary to climb on both sides.

The climbing formwork slides vertically so the formwork has no support on the ground. Because of this, it is necessary to build a supporting platform for the formwork at the required height. Said platform is built using the CLIMBING BRACKETS for support.

This ORMA CLIMBING BRACKET is only used to cover primary climbing needs on low walls 12-15m.

When climbing on both sides with high safety level requirements or high heights, other climbing brackets must be used.

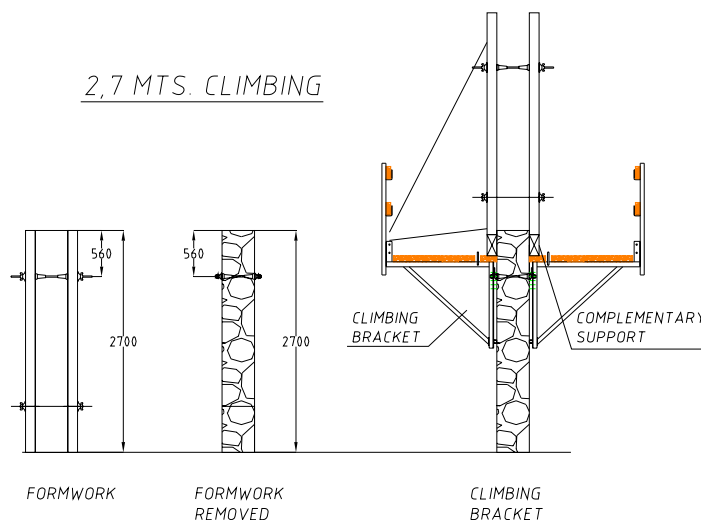
In this section we will just explain the climbing solution using the cone embedded in the concrete as a fixing element.

The CLIMBING BRACKETS are independent from the panel gangs.

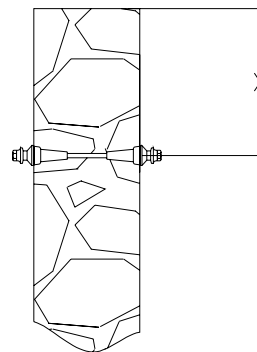
It is recommended to place a CLIMBING BRACKET approximately every 2.4m, which comes out the same for each large panel.

#### 3.16.1 Cone on tie rod

This method is only valid when climbing on both sides of the wall, since it is necessary to place the climbing components over the position of some of the formwork TIE RODS. This is usually on the panel's upper tie hole and therefore, the anchoring system works as tying element.



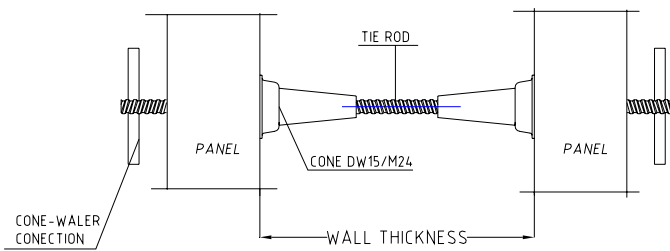
It is recommended to use panels 2.7m range for this type of climbings. If panels 3.3m range are used, for concrete levels between 2.7 to 3.3 m, the distance between the cone and the top surface of the wall (distance X, see picture below), turns out to be excessive.



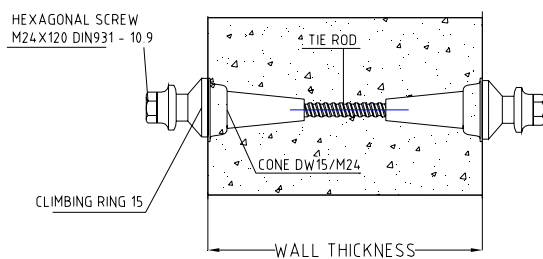
The climbing process comprises the following phases:

- Place the cones and the tie rods on the panel.  
The cones are tied by inserting the TIE RODS through the holes of the panels using CONE-WALER CONECTOR.  
The length of the tie rod connecting the cones depends on the wall thickness and its value will be  $L = \text{Thickness} - 160\text{mm}$ . It will remain in the wall at the end of the process.



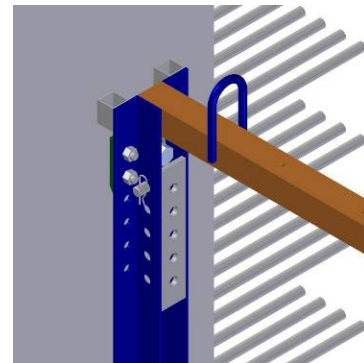
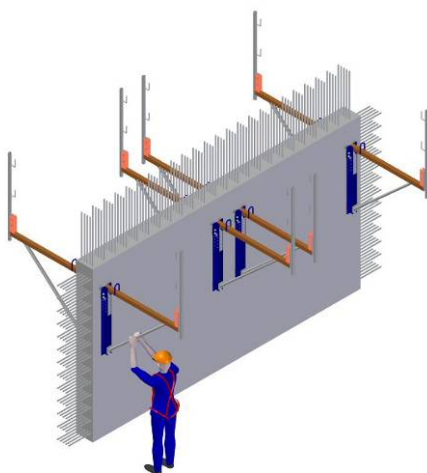


PHASE 1 - ON PANEL

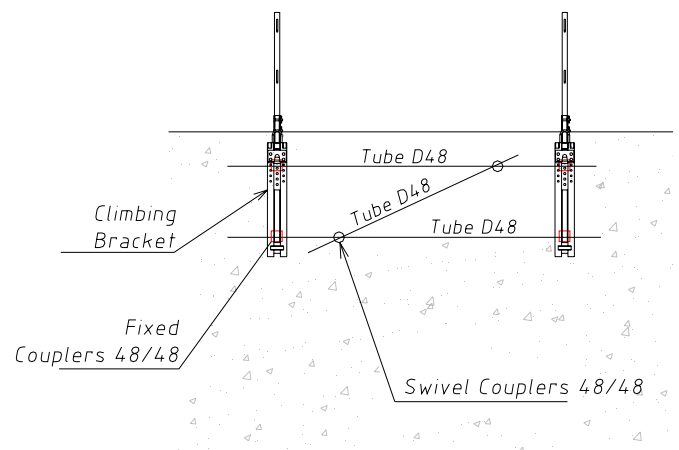


PHASE 2 - ON WALL

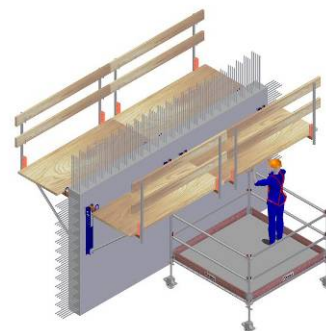
- Once the formwork has been stripped, the CLIMBING RING NT15 is inserted in the cones of the wall and fastened with HEXAGONAL SCREW M24X120
- The CLIMBING BRACKETS are then placed on the CLIMBING RINGS 15NT.



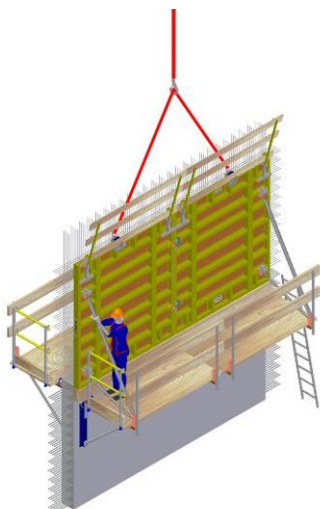
- The CLIMBING BRACKETS are braced in pairs using TUBES D48, FIXED COUPLERS 48 AND SWIVEL COUPLERS 48/48.



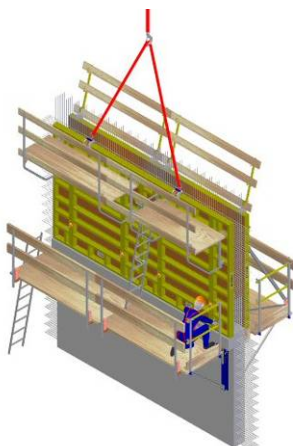
- The following components are used to make platforms and wooden handrails:
  - Platform planks: minimum of 20x5cm.
  - Handrail planks: minimum of 15x3cm.



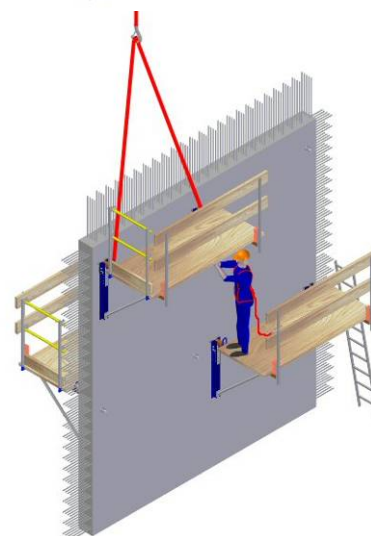
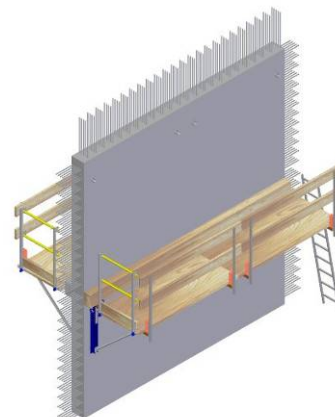
- The first face of the panels is lifted and put in place, securing them with the corresponding PUSH-PULL PROPS.



- The other side of the panels is put in place and connected to the TIE RODS before the pouring.



- The stripping process starts by removing the panels. The CLIMBING RING NT15 is placed on the cones before lifting the groups of brackets.

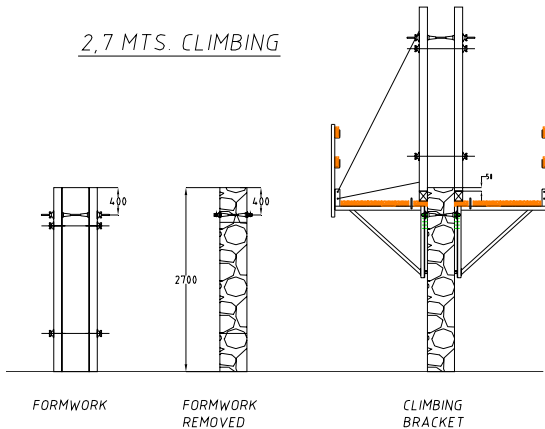


### 3.16.2 Cone on plywood

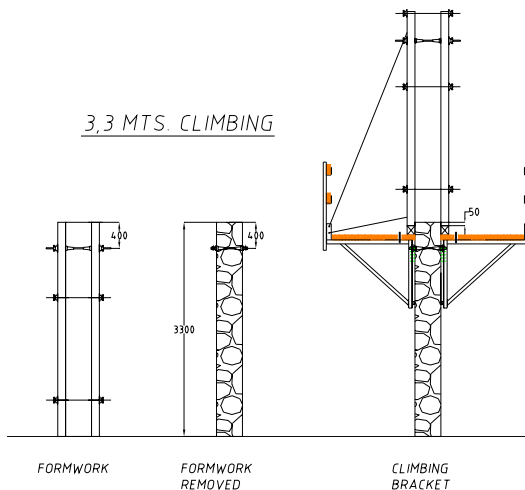
With this method the anchoring elements are placed in the desired position on the panel's plywood, and therefore it can be used for climbing on one or both sides of the wall.

It is problematic to make the holes in the plywood but the advantage is that the position of the CLIMBING BRACKETS on the wall can be better controlled, thus improving the accessibility to the elements and also the safety.

### 2,7 MTS. CLIMBING

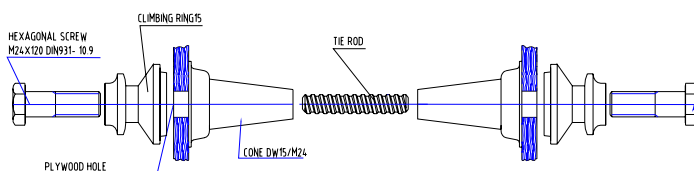


### 3,3 MTS. CLIMBING



In case climbing on both sides of the wall is necessary, the components are arranged as follows:

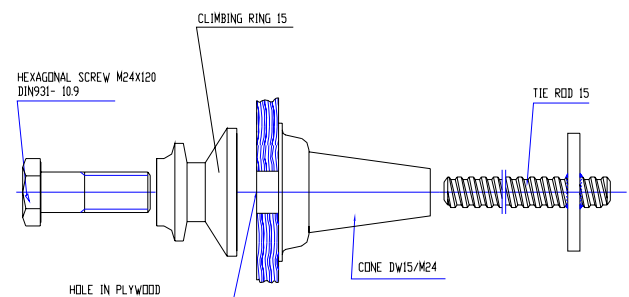
- Make a hole in the panels of both faces and fasten the CONE M24/DW15 secure the CLIMBING RING NT15 against the plywood using the SCREW M24 to screw through the hole.



### BOTH SIDES CLIMBING

If it is only necessary to climb on one of the wall faces, then the components are arranged as follows:

- Make the holes in the panels of that face and fasten the CONE M24/DW15 placing the CLIMBING RING NT15 against the plywood using SCREW M24 to screw through the hole. In these cases the lost tie rod on the cone should have a plate welded on its end so it can support the forces exerted on it.



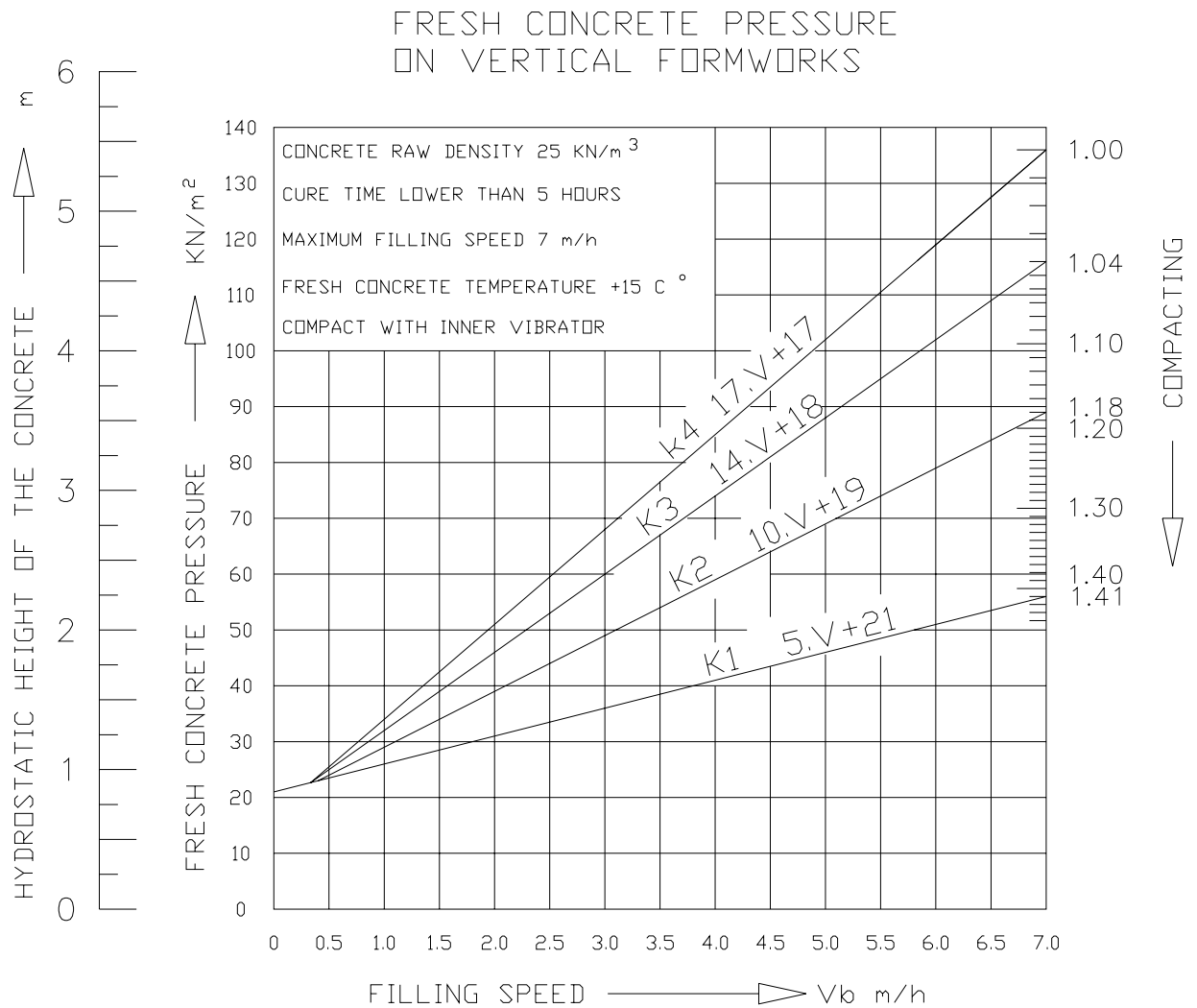
- The other steps to follow are identical to those in the previous section.

## 3.17. ONE FACE FORMWORK

The ORMA panels can be used as a solution for one face formwork, but due to the special characteristics of this type of project, a specific solution is necessary. It is recommended to use the available documentation for these solutions.



## **4. SYSTEM FEATURES**



## 4.2. PANELS WORKING LOADS

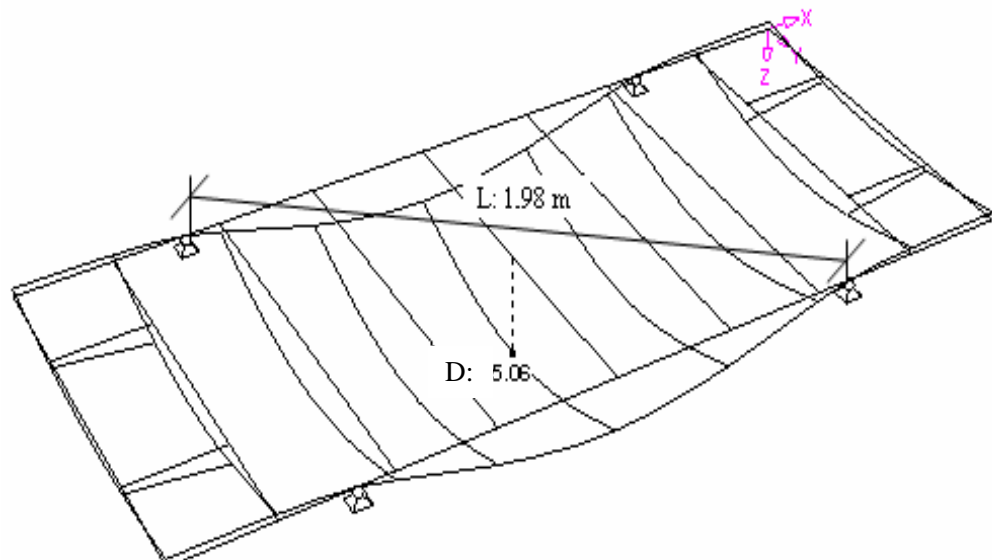
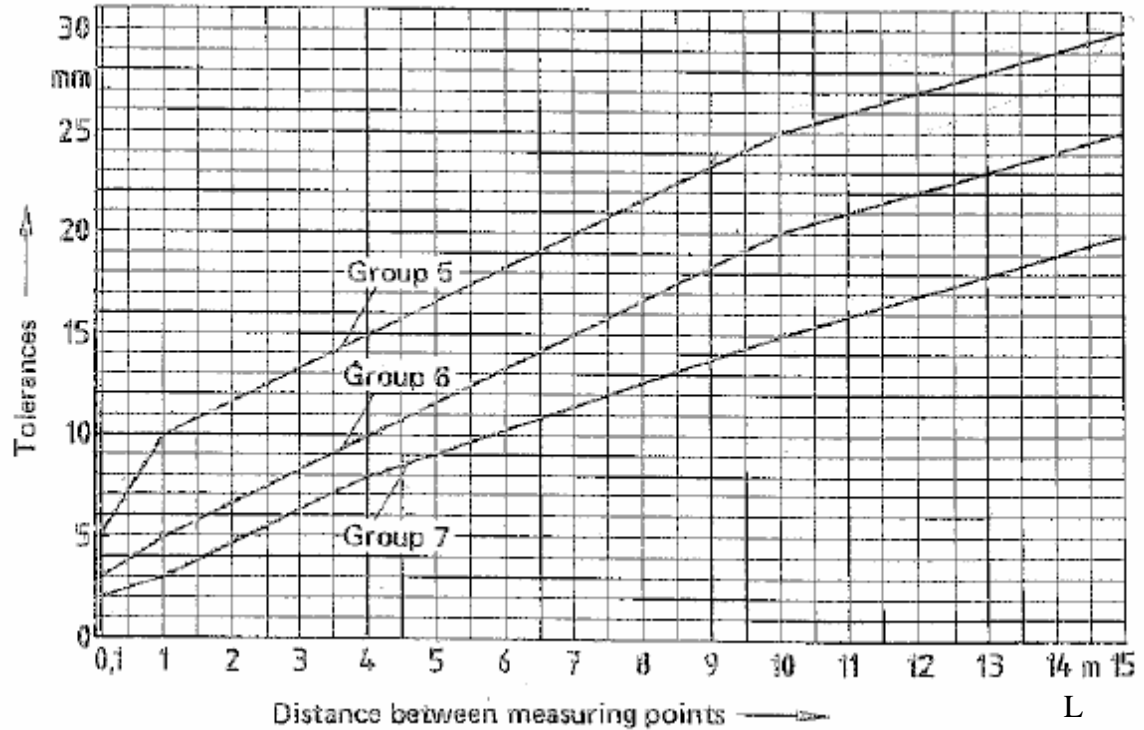
PANELS WORKING LOADS-RANGES 2.7 y 1.2- (GSV) <sup>(1)</sup>									
			Max. concrete pressure (kN/m <sup>2</sup> ) / DIN 18202 <sup>(2)</sup>			Max. tie load (kN) / DIN 18202			Ties per m <sup>2</sup>
Panel	m <sup>2</sup>	Type of load	Group 5	Group 6	Group 7	Group 5	Group 6	Group 7	
<b>2.7x2.4</b>	6.48	Max. hydrostatic I	67,5	67,5	67,5	85	85	85	0.62
		Max. constant	<b>74</b>	<b>74</b>	<b>60</b>	<b>120</b>	<b>120</b>	<b>97</b>	<b>0.62</b>
<b>2.7x1.2</b>	3.24	Max. hydrostatic I	67,5	67,5	67,5	85	85	85	0.62
		Max. constant	<b>74</b>	<b>74</b>	<b>55</b>	<b>120</b>	<b>120</b>	<b>89</b>	<b>0.62</b>
<b>2.7x0.9</b>	2.43	Max. hydrostatic I	67,5	67,5	67,5				0.82
		Max. constant	<b>80</b>	<b>80</b>	<b>80</b>	<b>97</b>	<b>97</b>	<b>97</b>	<b>0.82</b>
<b>1.2x1.2</b>	1.44	Max. hydrostatic I	67,5	67,5	67,5				1.38
		Max. constant	<b>74</b>	<b>74</b>	<b>74</b>	<b>54</b>	<b>54</b>	<b>54</b>	<b>1.38</b>

PANELS WORKING LOADS-RANGE 3.3- (GSV) <sup>(1)</sup>									
			Max. concrete pressure (kN/m <sup>2</sup> ) / DIN 18202 <sup>(2)</sup>			Max. tie load (kN) / DIN 18202			Ties per m <sup>2</sup>
Panel	m <sup>2</sup>	Type of load	Grupo 5	Grupo 6	Grupo 7	Grupo 5	Grupo 6	Grupo 7	
<b>3.3x2.4</b> (2x2 tie rods)	7.92	Max. hydrostatic	82.5	82.5	82.5				0.5
<b>3.3x2.4</b> (3x2 tie rods)	7.92	Max. constant	<b>80</b>	<b>80</b>	<b>65</b>	<b>147</b>	<b>147</b>	<b>119</b>	<b>0.75</b>
<b>3.3x1.2</b> (2x2 tie rods)	3.96	Max. hydrostatic	82.5	82.5	82.5				0.5
<b>3.3x1.2</b> (3x2 tie rods)	3.96	Max. constant	<b>80</b>	<b>80</b>	<b>60</b>	<b>147</b>	<b>147</b>	<b>111</b>	<b>0.75</b>

1) **GSV**: This is an organization that includes the main formwork manufacturers and it is in charge of certifying and checking up on the different products of the association members.

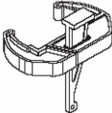
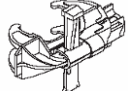
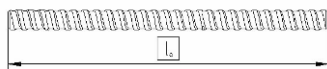
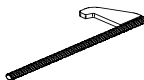


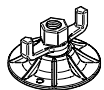

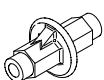

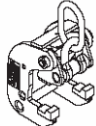
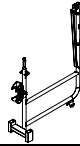
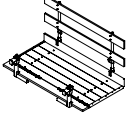
(2) **DIN 18202** (Flatness tolerances): The different quality levels of wall surfaces are defined in the following chart.

D



### 4.3. COMPONENTS WORKING LOADS

The following charts show us the working loads of each component:

Code	Name	Picture	Working Load
1900894	Fixed Clamp		15 kN
1900170	Adjustable Clamp		20 kN
	Tie Rod 15	 * Do not weld or heat the tie rods	90 kN
	Tie Rod 20		160 kN
1900227	Bulkhead Hook		15kN
7238001	Hexagonal Nut 15		90 kN
1900256	Plate Washer Nut 15		90 kN
1905160	Plate Washer Nut 20		160 kN
1905046	Wing Nut 20		160 kN
0230004	Water Stop DW15		90kN
1861094	Walkway Bracket		150 kg/m <sup>2</sup>
1900179	ORMA Lifting hook		CE certificate 15 kN
1900908	ORMA-BRIO Bracket		150 kg/m <sup>2</sup>
1908171	ORMA Platform 2.4X1.2		150 kg/m <sup>2</sup>



<b>ORMA PUSH-PULL PROP WORKING LOADS (TENSILE AND COMPRESSION)</b>			
<b>PUSH-PULL PROP 1.1-1.7</b>		<b>PUSH-PULL PROP 2.4-3.5</b>	
<b>L (m)</b>	<b>WORKING LOAD (kN)</b>	<b>L (m)</b>	<b>WORKING LOAD (kN)</b>
1.1	35.8	2.4	47.0
1.3	29.4	2.8	31.4
1.5	19.6	3.2	19.1
1.7	10.8	3.5	13.4
<b>PUSH-PULL PROP 3.6-4.8</b>		<b>PUSH-PULL PROP 5-6</b>	
<b>L (m)</b>	<b>WORKING LOAD (kN)</b>	<b>L (m)</b>	<b>WORKING LOAD (kN)</b>
3.6	32.3	5	16.3
4	26.5	5.25	14.2
4.4	21.6	5.5	12.7
4.8	16.2	5.75	11.8
		6	10.8

The load values for the PUSH-PULL PROP 6-10 follow:

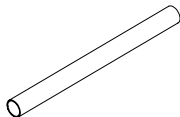
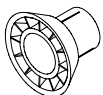

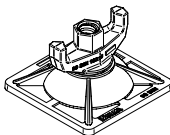
<b>WORKING LOADS ( TENSILE AND COMPRESSION) PUSH-PULL PROP 6-10</b>									
<b>Length (m)</b>	6	6.5	7	7.5	8	8.5	9	9.5	10
<b>Load (kN)</b>	33.3	33.3	28.5	23.5	19.6	16.6	13.7	11.8	9.8

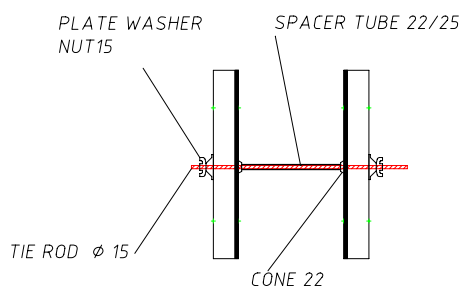
#### 4.4. TYING SYSTEM

The tying systems differ depending on the type of rod that will be used as support for the panels; the ORMA80kN/m<sup>2</sup> formwork allows the use of:

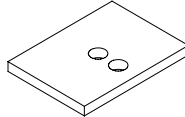
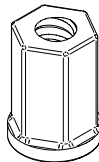
##### 4.4.1 Tie 15mm

Its base element is the 15mm TIE ROD, and it is composed of the following:

CODE	NAME	
7230455	Spacer tube 22/25	
7230264	End Cone 22	
According to length	Tie rod 15	
1900256	Plate washer nut 15	



The tying component PLATE WASHER NUT 15 can always be replaced by the combination of the ECCENTRIC WASHER + HEXAGONAL NUT 15.

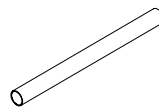
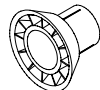

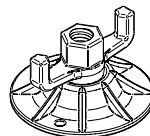
CODE	NAME	CODE
1861692	Eccentric washer	
7238001	Hexagonal nut 15	

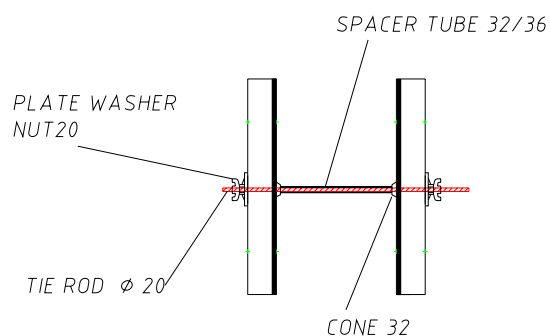
Once the panels have been stripped, the holes left by the TIE RODS can be plugged as follows:

- Place the PLUG 20 (Cod: 1861799) on the END CONE 22.
- Remove the END CONE 22 and place the PLUG 22 (Cod: 1900159) on the SPACER TUBE 22/25 that remains in the wall.

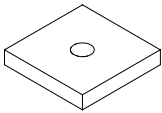
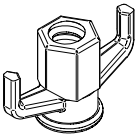
##### 4.4.2 Tie 20mm

Its base element is the 20mm TIE ROD, and it is composed of:

CODE	NAME	
9371968	Spacer tube 32/36	
9371967	End Cone 32	
According to length	Tie rod 20	
1900256	Plate washer nut 20	



In this system it will also be possible to replace the PLATE WASHER NUT 20 by the combination of BASE PLATE D20 + WING NUT 20.

CODE	NAME	
1905047	Base plate D20	
1905046	Wing nut 20	

Selection of the type of TIE ROD:

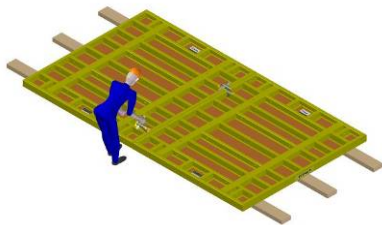
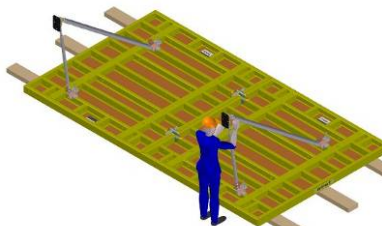
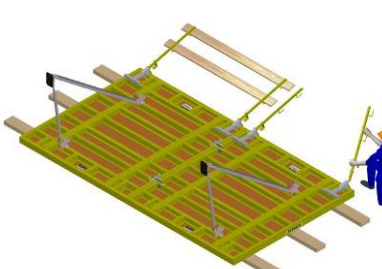
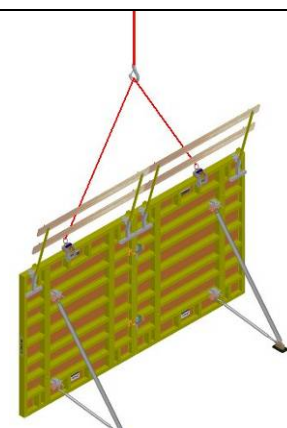
TIE ROD 20 → Concrete pressure  $\leq 80\text{kN/m}^2$


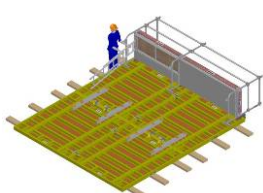
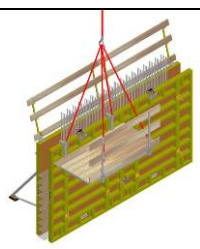
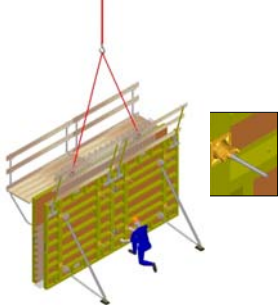
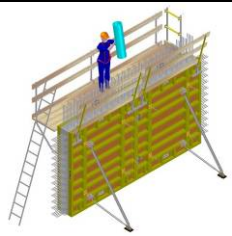
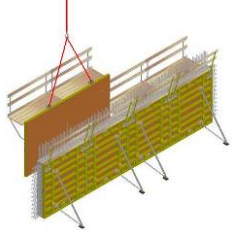
TIE ROD 15 → Concrete pressure  $\leq 60\text{kN/m}^2$

NOTE: In those cases that the pressure of concrete is higher than 60kN/m<sup>2</sup> and TIE ROD 15 is wanted to be used consult to the Technical Area

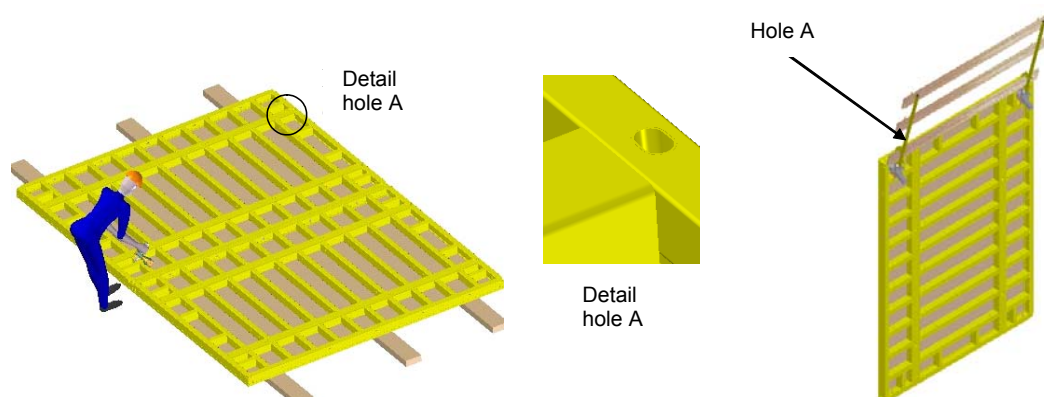
## **5. ASSEMBLY, USE AND DISASSEMBLY**

This section describes the steps in an ORMA gang assembly in detail, describing the different system elements that are used.

STEP	DESCRIPTION	SKETCH
1	Once the preassembly area is cleaned, place the bottom plank to support the formwork. Use a crane to put the panels on the sills using a certified lifting hook. Then, fix the panels using ORMA adjustable clamps.	
2	Assemble the heads, push-pull props and the push-pull prop shoes on the panels. (Section 5.1.).	
3	Assemble post brackets on the panels. Once they are placed, assemble the boards on the top and bottom handrails using wooden planks (Section 5.2.).	
4	Fasten the certified lifting hooks on the gang (section 5.3.). Lift the gang and move it to the final formwork position. Anchor the push-pull prop shoes to the ground using Hilti HAS M20x125 anchors.	

5	In the preassembly area repeat step 1 with new panels. Place the walkway brackets or working platforms according to the assembly drawing. Three different bracket types or working platforms can be used.	WALKWAY BRACKET (section 5.4.)	
		ORMA-BRIO BRACKET (section 5.5.)	
		ORMA PLATFORM 2.4X1.2 (section 5.6.)	
6	Lift the gang and place it in front of the other panel. Insert the tie rods and plate washer nuts to join the gangs. Remove the lifting hooks. These operations require the use of appropriate auxiliary equipment.		
7	Using appropriate auxiliary equipment, access to the working platform, install corner handrails and begin pouring the concrete.		
8	Once the concrete has cured completely, the formwork can be stripped. Access the working platform and secure the panels with lifting hooks. Remove all the plate washer nuts and tie rods from the panels to be dismantled. Remove the panels and put them on the ground, strike the clamps and remove brackets. After pouring, all the elements should be cleaned.		

ORMA 3.3m panel assembly is the same of ORMA 2.7m but It is necessary take into account that the panel 3.3m high should be placed with holes A (see drawing) in the top as soon as the panel is lifted.



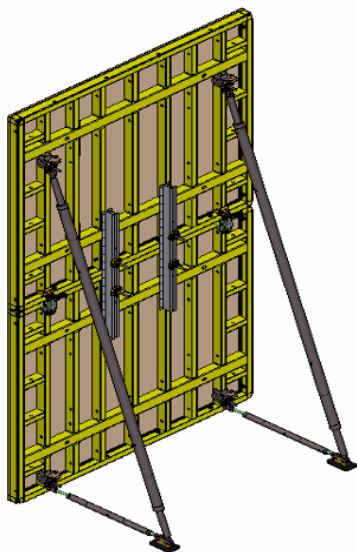
For further information about assembling,disassembling or handling different ORMA formwork elements, read and follow the technical instructions provided below:

- ITM 1: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO01-00”: ASSEMBLING ORMA WALL FORMWORK H< 5M
- ITM 2: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO01-00”: DISMANTLING ORMA WALL FORMWORK H< 5M
- ITM 3: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO03-00”: ASSEMBLING ORMA COLUMN FORMWORK H< 3.5 M
- ITM 4: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO04-00”: DISMANTLING ORMA COLUMN FORMWORK H< 3.5 M
- ITM 7: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO7-00”: ASSEMBLING ORMA CLIMBING SYSTEMS WITH CONES
- ITM 9: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO09-00”: ASSEMBLING ORMA WALL FORMWORK WITH POURING PLATFORM
- ITM 13: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO13-00”: ASSEMBLING ORMA COLUMN FORMWORK H>3.5M
- ITM 14: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO14-00”: DISMANTLING ORMA COLUMN FORMWORK H>3.5M
- ITM 15: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO15-00”: ASSEMBLING ORMA WALL FORMWORK WITH THE ORMA-BRIO BRACKET
- ITM 16: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO16-00”: DISMANTLING ORMA WALL FORMWORK WITH THE ORMA-BRIO BRACKET
- ITM 21: TECHNICAL INSTRUCTIONS OF ASSEMBLY “EO21-00”: ORMA WALL FORMWORK H>5M WITH WALKWAY BRACKETS ON ALL LEVELS
- ITM 22: TECHNICAL INSTRUCTIONS ON ASSEMBLY “EO21-00”: DISMANTLING ORMA WALL FORMWORK H>5M WITH WALKWAY BRACKETS ON ALL LEVELS

## 5.1. PUSH-PULL PROPS

The PUSH-PULL PROPS are used for the correct vertical positioning of panels or gangs.

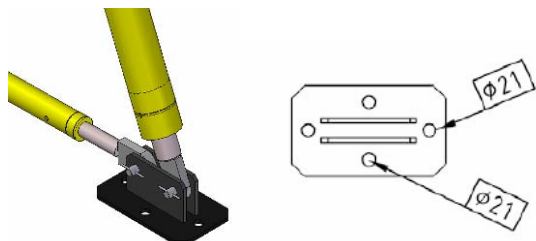
They also support temporary loads, as wind loads, during the assembly process.



The PUSH-PULL PROPS are anchored to the ground with the PUSH-PULL PROP SHOES. They are fastened to the ground using appropriate fixing elements.

The PUSH-PULL PROP 6-10 is equipped with a plate for this purpose.

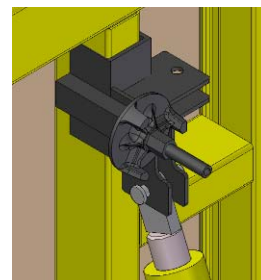
It is recommended to use Hilti HSA M20X125 anchors (Ftensile = 23.8kN), (Fshear = 29.6 kN), The manufacturer's assembly installation instructions should be followed at all times. Contractor has to follow manufacturer's installation instructions.



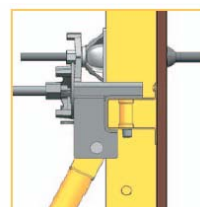
PUSH-PULL PROPS are attached to the panels using HEAD60, which is bolted through the holes in the horizontal and vertical ribs.



Horizontal rib

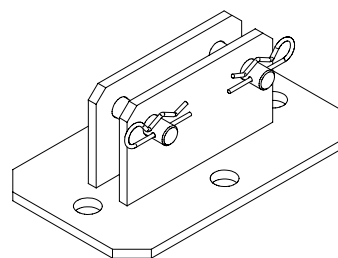


Vertical rib



Detail view: Tie

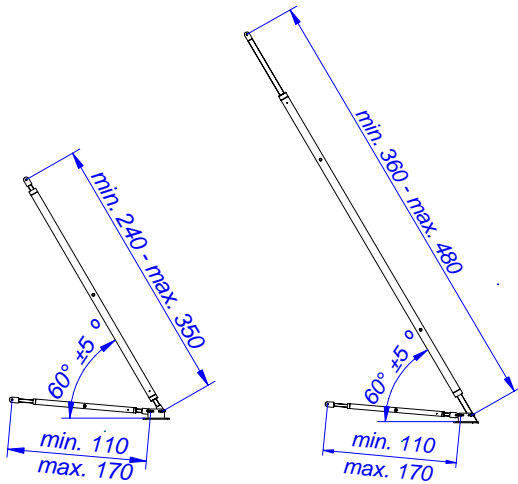
PUSH PULL PROPS are fixed to the head and the shoe using pins and cotter pins included in the head such as in the shoe.



There are four different types of PUSH-PULL PROPS. Depending on the formwork height, the appropriate push-pull props are used in combination.

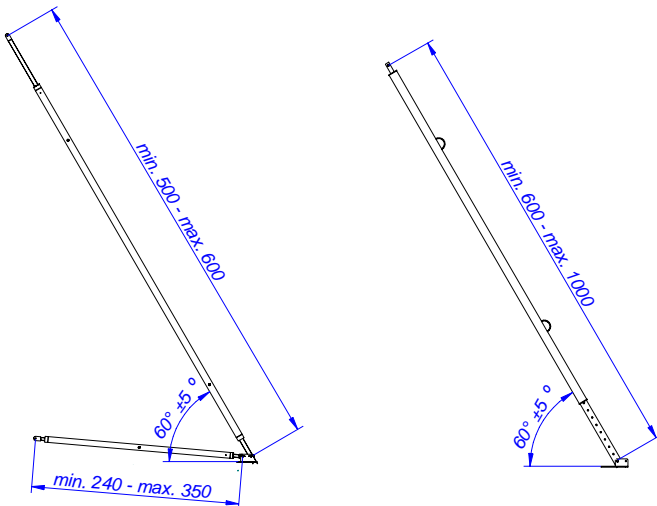
The number of components to place horizontally depends on the formwork height, but a maximum distance of 4.5m between them should never be exceeded.





1900134 Push-pull prop 1.1-1.7  
1900123 Push-pull prop 2.4-3.5

1900134 Push-pull prop 1.1-1.7  
1900123 Push-pull prop 3.6-4.8



1900123 Push-pull prop 2.4-3.5  
1900147 Push-pull prop 5-6

1900207 Push-pull  
prop 6-10

## 5.2. POST BRACKET

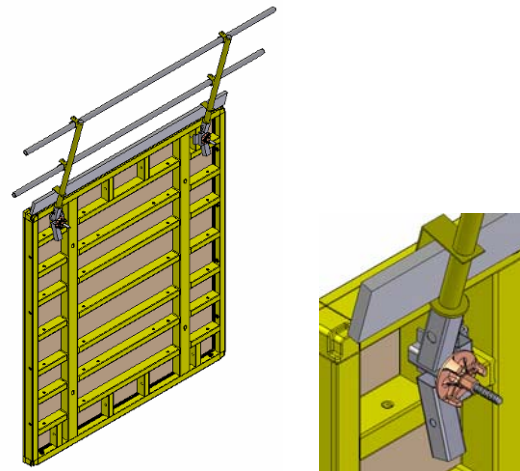
This element is always placed in a vertical rib holes, inserting the hook and fastening it with the FIXED PLATE NUT.

This bracket is used as support element where the SAFETY HANDRAIL POST SV is installed as a protection (handrail) on the opposite side of the WALKWAY BRACKETS or PLATFORM 2.4x1.2. Therefore, it is located in front of the pouring area.

The handrails are made of TUBES D42 and the toe board plank is at least 3x15cm.

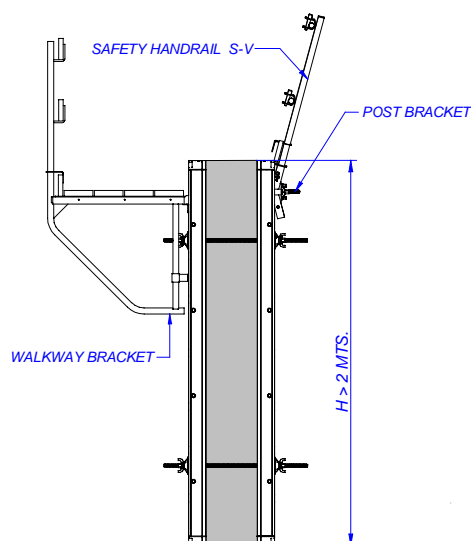
The maximum distance between two POST BRACKETS is 2m.

These posts include safety pins and cotter pins to fix these them to the POST BRACKET



The TUBES D42 is listed in the following chart:

CODE	NAME	WEIGHT (kg.)
2033700	TUBE 42/1.55	3
2033800	TUBE 42/2.1	3.4
2034000	TUBE 42/3.1	6.4
2033600	TUBE 42/4.1	8.4
2053000	TUBE 42/5	12.2
2023800	TUBE 42/4070 WITH SOCKET	8.4

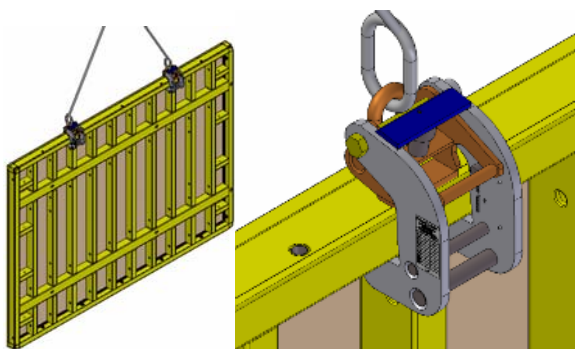


### 5.3. ORMA LIFTING HOOK

This element is an auxiliary component for lifting one panel or gangs using a crane. Each hook is designed to lift a maximum load of **1500Kg**, and the maximum recommendable angle between slings is 60°.

As a general rule, a minimum of two Hooks should be used when lifting panels or gangs. For gangs of 0.90m wide or less, a single hook could be used.

The LIFTING HOOK incorporates the “EC” certification in accordance with the European directive 98/37/CE on machinery and the “GS” mark from the Construction Committee of the “Office for Testing and Certifications” in Germany.

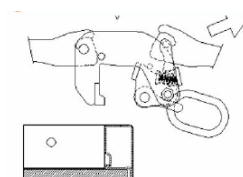


#### 5.3.1 Basic assembly

The basic installation can be divided into three phases:

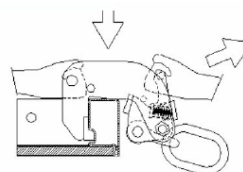
##### 5.3.1.1 The hook Opening

Hold the fixed part of the Hook with one hand and turn the mobile part with the other hand.



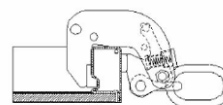
##### 5.3.1.2 The hook placement

Place the hook on the panel border profile, so that the Hook claw seats in the profile channel.

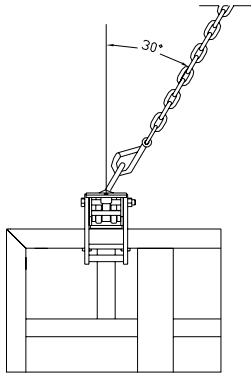


##### 5.3.1.3 The hook Fastening

Release the Hook assuring that it is correctly seated in both sides of the panel.



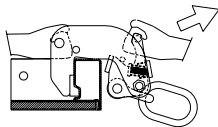
It is recommended to place the Hook on a rib in order to avoid lateral movements when lifting. Position the sling over the hook, taking into account that this should form a maximum of a 30° angle with the vertical.



### 5.3.2 Basic disassembly

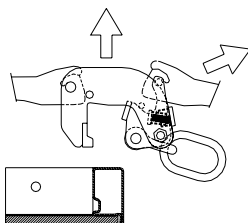
#### 5.3.2.1 *The hook Opening*

Hold the fixed part of the Hook with one hand and turn the mobile part with the other hand.



#### 5.3.2.2 *The hook Releasing*

The Hook is disengaged from the external Orma panel profile.



ULMA has specific documentation about the use, assembly and disassembly for the LIFTING HOOK. This documentation includes documents such as a USER'S MANUAL, and it is recommended to follow the instructions provided therein.

## 5.4. **WALKWAY BRACKET**

The ORMA WALKWAY BRACKET, placed on the top part of the panels, is used to provide support for the walkway from which concrete is poured or other works can be done.

This working platform should be assembled on the ground and the whole assembly lifted into place.

As general rule, two brackets should be assembled on each large panel. For smaller panels, a maximum distance of 2.1m is admitted, always assuring that the platforms are properly anchored.

The following elements must be used:

- Handrail planks: minimum of 15x3cm.
- Platform planks: minimum of 20x5cm.

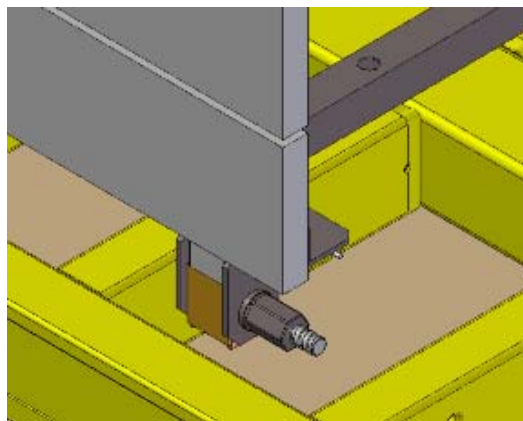
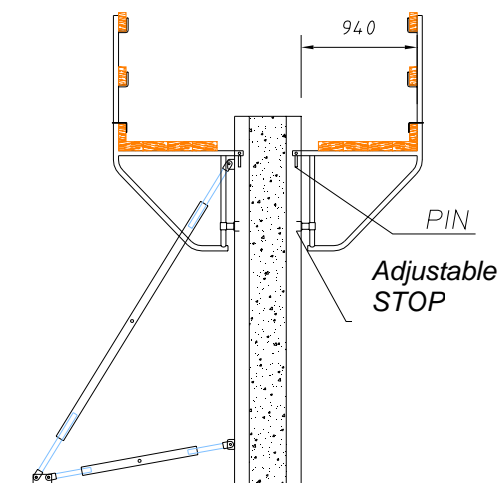
WALKWAY BRACKET load capacity: 150 Kg/m<sup>2</sup>

The BRACKETS can be assembled on the panels' vertical or horizontal ribs.

### 5.4.1 Horizontal ribs

The WALKWAY BRACKET is assembled by inserting its pin in one of the ribs' holes and the adjustable element is supported on the lower rib to provide stability.

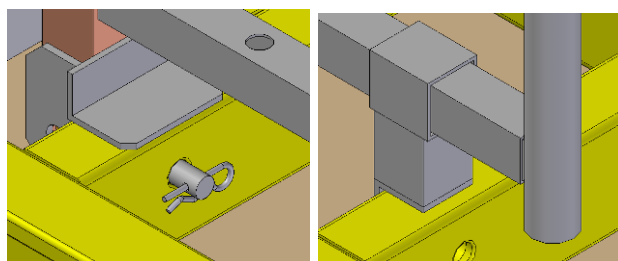
The main pin of the bracket includes a safety cotter pin to fix it to the panel avoiding problems during lifting and movement of the panels.



### 5.4.3 Basic assembly

Place wooden planks until covering the working surface, assuring that the 2 supports are correctly secured, thus guaranteeing the boards cannot move.

Assemble upper and intermediate wood handrails and toe boards on the safety handrail posts of the walkway bracket. For this handrail, the brackets provide L shaped post, where the wooden planks are placed. The wooden toe board should be supported on the bottom part of working platform. It is recommended to use planks which are in good condition, thus do not have any knots,

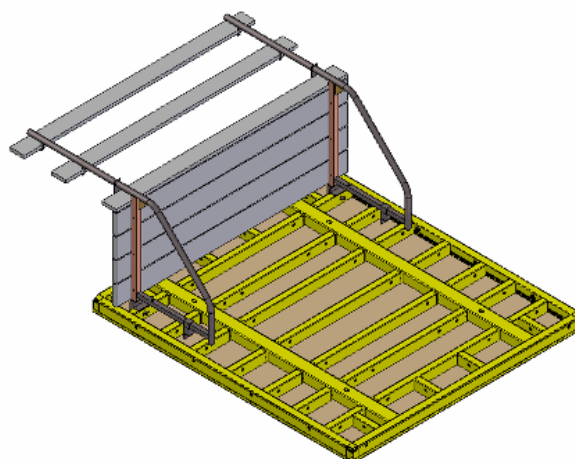


**Detail view: pin inserted in the rib and lower adjustable stop supported on lower rib.**



### 5.4.2 Vertical ribs

The WALKWAY BRACKET is laterally bolted in one of the holes of the vertical rib by inserting the PANEL BOLT through the hole in the bracket and fastening with the HEXAGONAL NUT15 on the other side.



## 5.5. ORMA-BRIO BRACKET

This bracket is installed on Orma formwork panels and providing working platforms on different levels utilizing standard BRIO scaffolding elements such as platforms, ledgers, etc.

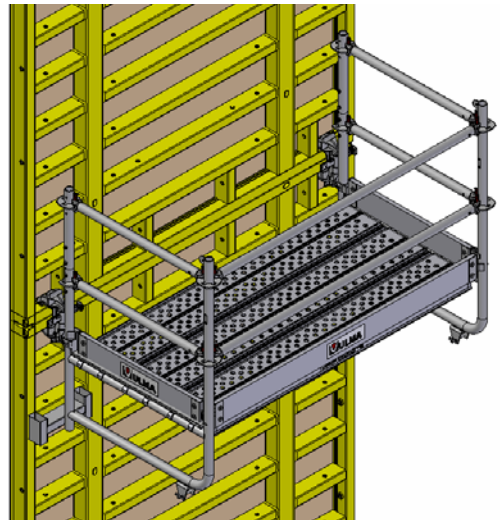
This bracket incorporates an ORMA clamp (to fix it to any position on the outside profiles of the ORMA panels) and some BRIO collars (to permit adapting the horizontal ledgers between walkway brackets creating the safety handrails).

The horizontal tube of the bracket is used as support for steel platforms and ladders.

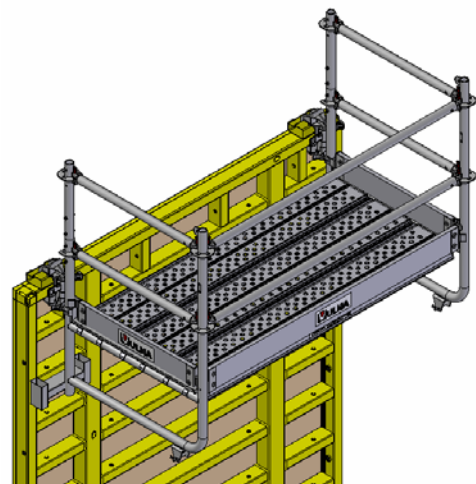
The most important characteristics of the product follow:

- Versatility in the walkway bracket position, which allows placing it in any position of the horizontal joint between panels.
- Access between walkway brackets on different levels is achieved with the TELESCOPIC LADDER.
- The platforms are secured while lifting the gang.
- Bracket load capacity: 150 Kg/m<sup>2</sup>, on platforms with a maximum distance of 3m between brackets.
- Different Types of platforms:
  - \* 320 mm wide steel platforms
  - \* 640 mm wide combi platforms
  - \* 640 mm wide platforms with ladder
- The walkway will be composed of:
  - \* Three 320 mm platforms
  - \* One 640 mm platform with ladder and one 320 mm platform (640 mm platform will be on the side closest to the panel).
- The platforms provide access to assemble the tie rods, the clamps and to the lifting hooks.

- The WALKWAY BRACKET includes a head to place the PUSH-PULL PROPS.
- The ledgers, posts and toe boards are components of the BRIO scaffolding system.
- It is recommendable to do a layout study for jobsites to take into account the position of the brackets in the ORMA gangs.








**INTERMEDIATE ASSEMBLY BETWEEN PANELS  
FASTENING DIRECTLY TO THE JOINT PROFILES**








**UPPER ASSEMBLY  
TYING PROFILE + PANEL PROFILE**



### 5.5.1 Basic assembly

	<p><b>PANEL ASSEMBLY</b></p> <p>First, the Orma Panel gangs will be assembled with their clamps and walers on the ground supported by wooden planks.</p>
	<p><b>BRACKET PLACEMENT</b></p> <p>The bracket will be placed on the upper part of the panel depending on the layout defined on the drawing. They will be securely fixed to the tying profile on the panel's upper profile.</p>
	<p><b>TYING PROFILE</b></p> <p>The tying profile is seated perfectly on the panel's upper profile. The flat bars of the tying profile will remain in contact with the panel board.</p>
	<p><b>LEDGERS PLACEMENT</b></p> <p>The 2nd bracket will be placed at a distance equal to the length of the ledger to be assembled. The distance between brackets should be exactly 3m, 2.5m, 2m, 1.5m, 1.02m or 0.07m in accordance with the lengths of the BRIO platforms. In the cases when a platform with ladder is used, distances will be limited to 3m, 2.5m and 2m.</p>
	<p><b>PLATFORMS PLACEMENT</b></p> <p>The platforms will be placed on the brackets, always placing the platform with ladder as far as possible from the panel. After that, tubes are placed to hold the platforms so they do not fall while lifting the gangs.</p>

	<p><b>PLACEMENT OF LATERAL HANDRAILS AND TOE BOARDS</b></p> <p>For the placement of the lateral handrail the inside part of the bracket has to be increased with a 0.5 or 1m post to be able to place the upper 1.02 m horizontal ledger. Then, the toe boards are placed.</p>
	<p><b>LADDER SUPPLEMENT PLACEMENT</b></p> <p>If it is necessary, connect the supplement to the ladder incorporated to the BRIO platform</p>
	<p><b>LOWER MODULE PLACEMENT</b></p> <p>Place the lower module in the intermediate joint between the panels following the same process as that used from the beginning.</p>
	<p><b>PUSH-PULL PROPS PLACEMENT</b></p> <p>The corresponding push-pull props will be placed in the U to stabilize the bracket. The other corner of the push-pull props will be anchored in the ground.</p>
	<p><b>MODULE LIFTING</b></p> <p>Once the assembly is complete, the gang will be lifted to its final position, with the lifting hooks.</p>



Real jobsite application

Note: The disassembly process is the same as the assembly process executed in reverse order.



## 5.6. ORMA PLATFORM 2.4x1.2

This ORMA PLATFORM 2.4X1.2 is used as a working platform for wall forming.

This ORMA PLATFORM and the WALKWAY BRACKET have the same function.

It is always placed on the upper part of the ORMA panel whether it is in the vertical or horizontal position, and it is ideal for straight geometries that do not have pilasters, corners, etc.

The load capacity of the platform is 150 Kg/m<sup>2</sup>.

### 5.6.1 Basic assembly

The ORMA PLATFORM 2.4X1.2 is stored and supplied to the customer with the back handrail folded.

To unfold the handrail, simply release the upper pins on the rear tubes, lift the handrail into position and insert the pins.



**Folded platform**



**Upper pin**



**Inserting the pins**



**Handrail in position**

This ORMA platform for pouring concrete also offers the option of positioning the handrail at a 14° angle with respect to the vertical.



**Inclined handrail 14°**

This incline is achieved by releasing the lower bolts of the back tubes, turning it and inserting the bolts in the bolt hole that corresponds to that angle.



**Lower bolt**



**Lower bolt at 14°**



Once the handrail has been unfolded, the platform is lifted by 4 slings: two on the front side and the other two on the back handrail tubes.



**Lifting platform**

Then, fasten the ORMA PLATFORM on the top part of the panel. Once the platform is lifted into place and pressure is released from the slings, the safety hooks will fall by gravity, thus assuring that the platform cannot be released unintentionally.



**Platform placed on the top of the panel**



**Pressure released from swing, platform locked into profile by gravity**

If it is necessary to place accessories on the top part of the panel, heads for push-pull props, etc, there is a trap door that turns on a hinge leaving space for it.



**Closed trap door**



**Opened trap door**

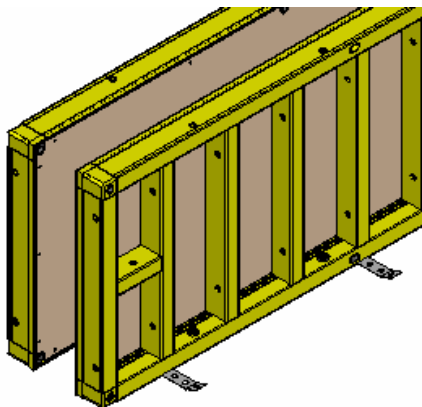


**Real application on jobsite**

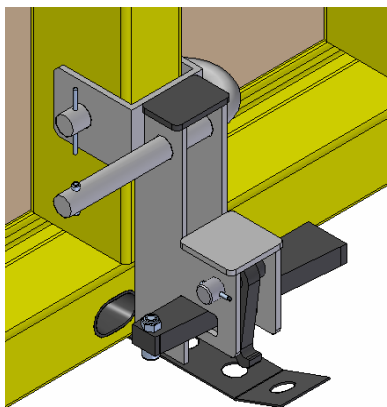
## 5.7. FOUNDATION

Foundation system assembly should be as follows:

- Cut strips of FOUNDATION PLATE based on thickness of the wall. Place these strips under the panels and always in line with one of the vertical panel's ribs. The plate only covers wall thicknesses that are multiples of 50 mm.



- Fix the FOUNDATION HEAD on the panels with a rounded pin, on both sides of the wall.



- Fasten the hook in one of the foundation plate holes, and anchor the system by striking the wedge with a hammer.

There are some rules that should be followed when distributing the PLATES and FOUNDATION HEADS:

- For wall heights that are less than or equal to 0.9m, the foundation system should be placed every 1.2m.
- For wall heights that are greater than 0.9 m and less than or equal to 1.2m, the foundation system should be placed every 0.6m.
- For walls higher than 1.2m, a calculation should be made to solve the distance between foundation heads taking into account that the working load for the foundation plate is of 12 kN.

## **6. CONDITIONS OF USE**

## **6.1. GENERAL CONDITIONS OF USE**

- Follow the instructions for the project in execution at all times.
- Follow the general manufacturer's instructions at all times.
- Formwork shall be assembled and stripped by qualified personnel, who are supervised, overseen and managed by a competent person.
- If the working area is close to high voltage power lines, power should be shut off while working is in progress. If this is not possible, take the necessary protective measures recommended in the current applicable standard.
- Do not work with formwork when wind speeds are in excess of 60 km/h, or when there is ice or snow.
- The crane used must be strong enough for the handling and assembly of the gangs.
- The auxiliary lifting elements should be appropriate for the loads to be lifted. They should be checked before each use and discarded if found to be faulty.
- If the ORMA lifting hook is used, it should be used following the instructions provided by the manufacturer.
- If, due to conditions of the work environment, the crane operator does not have the capacity to view the whole trajectory over which the load is moved, the transport operations will be guided by a signalman, who will communicate with the crane operator using predefined signals.

- Under no circumstances shall people loiter beneath or in the path of elevated loads.

### **6.1.1 Framing**

- For stacking formwork panels on the ground, frames will be placed on planks or similar materials and distributed to avoid any damage, facilitating organization, cleanliness and posterior distribution of the panels to their assembly positions.
- All gang positioning and assembly processes will be performed following safe work procedures.
- Proper leveling and bracing shall be applied based on terrain and/or climate conditions.
- New gang shall not be mounted in the working area until the previous gang has been properly secured.
- No component should be left partially assembled.
- The working platforms should never be overloaded. Only elements required for fluid work flow should be stacked on them.
- Climbing through the formwork panels is prohibited except in exceptional cases that have been duly studied, and proper safety equipment must be used.
- Check that all the clamps are correctly wedged to assure that no grout is lost through the joints.
- Make sure that all the plate washer nuts are properly tightened, the push-pull props are properly placed and tightened and the push-pull prop shoes are correctly anchored to the ground.

- Respect the maximum hydrostatic pressures of the formwork system (according to product instructions).
- The formwork surfaces should be checked and cleaned before pouring concrete.
- Release agent should be applied to a cloth or brush and used to clean the panels after each use. Do not use wire brushes that can damage the phenolic film of the plywood.
- It is important to know whenever the plywood's phenolic film suffers damage due to the chemical and abrasive action of the concrete, and it is recommended to pay special attention to the seal over the holes and deteriorated areas.
- Any plywood border that is cut should be sealed as soon as possible, because if water penetrates the plywood it will swell and made the plywood thicken.
- It is not recommended to use nails or screws.
- Panels should always be stored after their last use at the construction site. Before stacking the panels, they must be cleaned. Then, they should be stacked by placing a wooden piece between one panel and the next. They should be kept of the ground by stacking them on supports that are leveled, and they should be stored under a roof since prolonged exposure to sunlight and rain may damage them.

### 6.1.2 Release agent

- Release agent should be used to keep concrete from sticking to the formwork,

thus increasing number of times a panel can be used.

- The release agent plays an important role in assuring the quality of the concrete surface. It serves the purpose of assuring there are no surface holes and that color is uniform.
- It should be applied uniformly on the wall in thin coats. Usage and correct use guidelines should be taken into account at all times.
- The panel surfaces should be cleaned carefully before applying the release agent.
- It is recommended to clean the metal frame, and apply the release agent to the frame every 4 or 5 pourings.

### 6.1.3 Pouring

- It is recommended to pour the concrete from the lowest possible height; never higher than 2m if it is not poured through a conduit, pipe or other pouring accessory, It is good to pour as close as possible to the base, without pouring directly against the formwork at a single point.
- The concrete is poured in layers or levels of uniform thickness: 30 to 45 cm per layer.
- The condition of the formwork will be overseen while pouring concrete. Pouring will be stopped if any incident is detected.
- Do not permit concrete to splash on the high sides of the panels to assure that stains are not caused by the same.
- If concrete is poured from a bucket, special care should be taken to avoid hitting the

formwork with the bucket and to avoid exceeding the crane's load limit.

- The appropriate compacting system should be used for the consistency and workability of the concrete. This should be appropriate for the vibrator used.
- The internal vibrators are better for compacting the concrete on site, and the external vibrators, which vibrate through the panels, should only be used when holes cannot be accessed or for parts that are molded in workshops offsite.
- The needle vibrator should penetrate the concrete by 10 to 15cm.
- The needle vibrator should never come in contact with the formwork surface to assure the expected loads are not exceeded.
- The vibrator should penetrate the concrete quickly, and be held still, vertical and slightly inclined for 10 to 30 seconds or until the concrete flows back to the surface.
- Remove the vibrator slowly and carefully.

#### **6.1.4 Stripping and curing**

- Before starting the stripping process, the concrete must have the minimum resistance to avoid losing concrete next to the surface since this would affect the surface resistance and durability of the concrete.
- The time before beginning the stripping process should be increased when there are low temperatures or strong winds that could result in quickly drying the surface.

- The same time interval should be respected while stripping other elements from the construction area. From the point of view of surface quality, this is justified since the surface quality is directly linked to and influenced by the time over which the surface is isolated from the surrounding environment.
- During the stripping process, check that there are no people near and verify that there is no loose material that can fall from the platforms.
- Vertical elements should be dismantled from top to bottom.
- Once the gang is stripped, it will be supported on the frames where it will then be cleaned and totally disassembled if no more concrete is going to be poured.
- Before using any material, it should be checked to confirm that all components are in proper working conditions.

#### **6.1.5 Personal and collective protective equipment**

- Regulatory safety equipment should be used when working, or work platforms with their corresponding safety handrails should be used (collective safety equipment).
- Personal protective equipment to be used should include at least: helmet, safety footwear, gloves and a tool belt.
- Other personal protective equipment should be used depending on the site guidelines, drawn up based on risk assessments.

## 7. HANDLING AND MAINTENANCE CONDITIONS

Proper storage of components is a fundamental necessity for their preservation. Optimal storage conditions include:

- Place the pieces of the same type and dimensions on or in elements that have been exclusively designed for them (baskets, pallets, boxes, etc.).
- In order to avoid part deformation, do not strap the metal strips too tightly.
- Apply the metal strips sufficiently tight to assure the parts cannot move.
- Use protectors to guard the components from the excessive pressure exerted by the metal strips.
- Do not permit parts to hit against one another while the material is being moved.



## **8. LEGAL AND STANDARD REFERENCES ON THE PREVENTION OF OCCUPATIONAL AND ENVIRONMENTAL HAZARDS**

89/391/EEC Directive Health and Safety in the Workplace

89/654/EEC Health and Safety in the Workplace

92/57/EEC Health and Safety at Construction Sites

92/58/EEC Health and Safety Signposting in the Workplace

89/655/EEC, 95/63/EC, 2001/45/EC Using Work Equipment

89/656/EEC Personal Protective Equipment (PPE)

90/269/EEC Manually Handling Loads

2002/44/EC Risks Derived from Physical Agents (Vibrations)

2003/10/EC Risks Derived from Physical Agents (Noise)

UNE-EN 13374: Temporary border protection systems, product specifications, test methods